JOURNAL OF CREATION
Vol. 29(1) 2015 ISSN 1036-2916 CREATION.com

DINO-BIRD THEORY
A FLIGHT OF FANCY

TRINITY'S TRUTH REFLECTED IN CREATION

Becoming one flesh

ICE AGE MEGAFLOODS:
Insight into Flood sedimentation

WATER DESTRUCTIVE
FOR ATHEISTIC ORIGIN OF LIFE

JOURNAL OF CREATION

An international journal devoted to the presentation and discussion of technical aspects of the sciences such as geology, biology, astronomy, etc., and also geography, archaeology, biblical history, philosophy, etc., as they relate to the study of biblical creation and Noah's Flood.

COVER: Close up of a keel-billed toucan (*Ramphastos sulfuratus*).

PHOTO: © Joanne-Weston/istockphoto.com

Editorial correspondence should be addressed to:

The Editor
Journal of Creation
Creation Ministries International
PO Box 4545
Eight Mile Plains
QLD 4113
AUSTRALIA

Email: journal@creation.info

SUBSCRIPTION INFORMATION

AUSTRALIA
Creation Ministries International
P.O. Box 4545,
Eight Mile Plains QLD 4113, Australia
Phone: (07) 3340 9888
Fax: (07) 3340 9889
Subscription: A$39 (3 issues)

CANADA
Creation Ministries International
300 Mill St, Unit 7, Kitchener, ON
N2M 5G8
Phone: (519) 746 7616
Fax: (519) 746 7617
Subscriptions and orders only:
1–888–251–5360
Subscription: C$39 (3 issues)

NEW ZEALAND
Creation Ministries International
P.O. Box 39005, Howick,
Auckland 2145, New Zealand
Phone and fax: (09) 537 4818
Subscription: NZ$59 (3 issues)

SINGAPORE
Creation Ministries International
P.O. Box 195, 911207, Singapore
Phone and fax: (65) 9698 4292
Subscription: S$50 (3 issues)

SOUTH AFRICA
Creation Ministries International
P.O. Box 3349,
Durbanville 7551, South Africa
Phone: (021) 979 0107
Fax: (086) 519 0555
Subscription: R260 (3 issues)

UK and EUROPE
Creation Ministries International
15 Station Street
Whetstone
Leicestershire, LE8 6JS
United Kingdom
Phone: (44) 0116 2848 999
(To email use web 'contact us' form)
Subscription: £25 (3 issues)

USA
Creation Ministries International
P.O. Box 350,
Powder Springs, GA 30127, USA.
Phone: (800) 6161-CMI
Fax: (770) 439 9784
Subscription: US$39 (3 issues)

OTHER COUNTRIES
Creation Ministries International
P.O. Box 4545,
Eight Mile Plains QLD 4113, Australia
Phone: (+617) 3340 9888
Fax: (+617) 3340 9889
Subscription: A$46 (3 issues):
Please remit in Australian dollars or
advise MasterCard or Visa card details

CREATION.com

Printed in Australia,
Published by:
Creation Ministries International Ltd
ABN 31 010 120 304

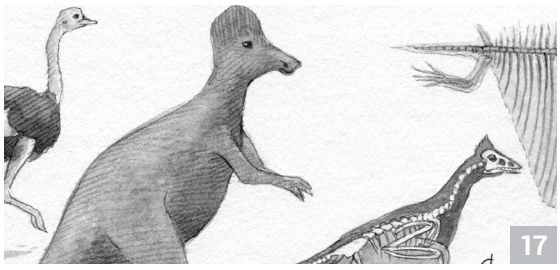
CREATION MINISTRIES INTERNATIONAL
Worldwide Outreach

Creation Ministries International (CMI)—formerly *Answers in Genesis* in Australia, Canada, New Zealand, Singapore, South Africa and UK/Europe—is a non-profit evangelical group of ministries around the world which, though independent, form an operational unity. We share not only this *Journal of Creation* and the associated *Creation* family magazine, but the same biblical platform, and overall outreach and educational vision. In addition, we communicate and co-operate with bona-fide creationist researchers from all over the world. The expanding effectiveness of these ministries, and the future of quality biblical creation research in general, depends on donations from concerned individuals. These may be made to the CMI office in your country. For other countries, our Australian office is able to receive personal cheques in your own currency, or simply write, phone or fax with your MasterCard or Visa details (including expiry date and amount). We are a fully audited ministry.

PERSPECTIVES

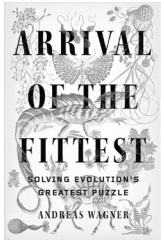
The natural world is replete with instances of processes that do not conform to the accepted scientific dogma of the day.

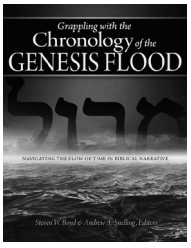
OVERVIEWS

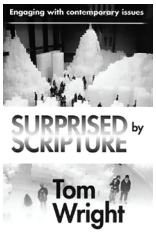


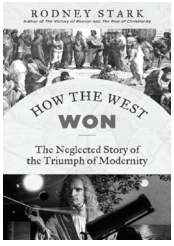
Attempts to document the evolution of birds is no closer today than it was at the time of Darwin.

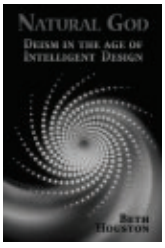
BOOK REVIEWS



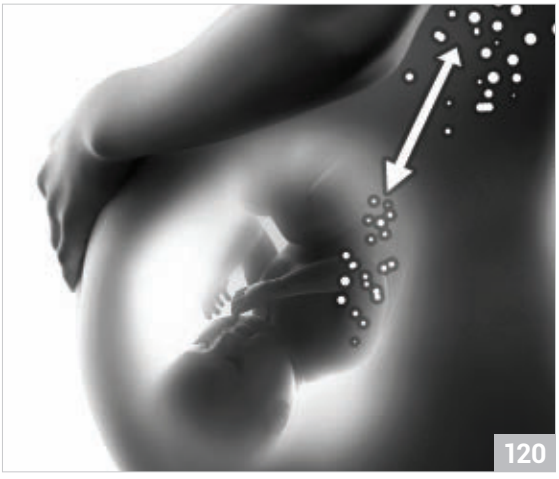








LETTERS



Recent discovery of the DNA of men in the bodies of women, has brought attention to the biological closeness shared between a woman and her spouse.

PAPERS

ESSAYS

ABOUT US

CREATION MINISTRIES INTERNATIONAL

What is Creation Ministries International Ltd?

Creation Ministries International Ltd. is an independent, non-profit, non-denominational organization, controlled by Christians in the fields of science and education, committed to researching, developing, and promoting Christian creationist materials, and Christian school texts and aids. Our work is based on acceptance of:

» The Bible is the written Word of God. It is divinely inspired and inerrant throughout.

» The final guide to the interpretation of Scripture is Scripture itself.

» The account of origins presented in Genesis is a simple but factual presentation of actual events and therefore provides a reliable framework for scientific research into the question of the origin and history of life, mankind, the earth and the universe.

» Scripture teaches a recent origin for man and the whole creation.

» The great Flood of Genesis was an actual historic event, worldwide (global) in its extent and effect.

» The special creation of Adam (as one man) and Eve (as one woman) and their subsequent fall into sin, is the basis for the necessity of salvation for mankind (and thus for the Gospel of Jesus Christ).

» The scientific aspects of creation are important, but are secondary in importance to the proclamation of the Gospel of Jesus Christ as Sovereign, Creator, Redeemer and Judge.

Please note that in all of this, we openly proclaim that our work is centred around Jesus Christ. We are convinced that the real needs of men and women can only be met by reconciliation to God through faith in and commitment to Jesus Christ the Creator, as Lord and Saviour.

The views expressed in *Journal of Creation* are those of the writer(s) and not necessarily those of the Editors of *Journal of Creation* or the Directors of *Creation Ministries International.*

For instructions to authors, see the last page.

On metal abundances vs redshift in creationist cosmologies

John Hartnett

In astronomy, metallicity applies to all elements other than hydrogen and helium. The term 'metal' in astronomy describes all elements heavier than helium.[1,2] A systematic trend of weighted mean metallicity as a function of look-back time in the universe is sometimes shown in support of the standard big bang model.[3] Though stated, some find that this trend is not always so well supported by the observational data.[4]

Does this rule out certain creationist cosmologies? Take for example, Lisle's Anisotropic Synchrony Convention (ASC) model,[5] which essentially describes all galaxies with the same youthful age of about 6,000 years but includes the notion of a mature creation. According to Lisle no ages of any structures in the universe should be greater than 6,000 years. Therefore, based on evolutionary assumptions, if some object appears older due to so-called maturity, i.e. a fully formed galaxy, then that is inbuilt maturity that was from the creation.[6]

And what would you expect from the time dilation cosmologies of Hartnett[7] and Humphreys[8]? In those models the solar system is young, not billions of years old, but they have reasonable amounts of cosmic time that may be hundreds of millions of Earth years during Creation Day 4.

So what do we expect to see in the cosmos?

In the standard big bang cosmology, metallicity should decrease with distance from Earth because of several assumptions. These include the assumption that distance in the universe means longer travel times, hence we are looking back at sources when they were younger. Hence following this is the assumption that younger galaxies comprise more younger stars than older galaxies do and younger stars generally comprise less metals. Therefore, at greater redshifts we should observe more metal-poor galaxies.

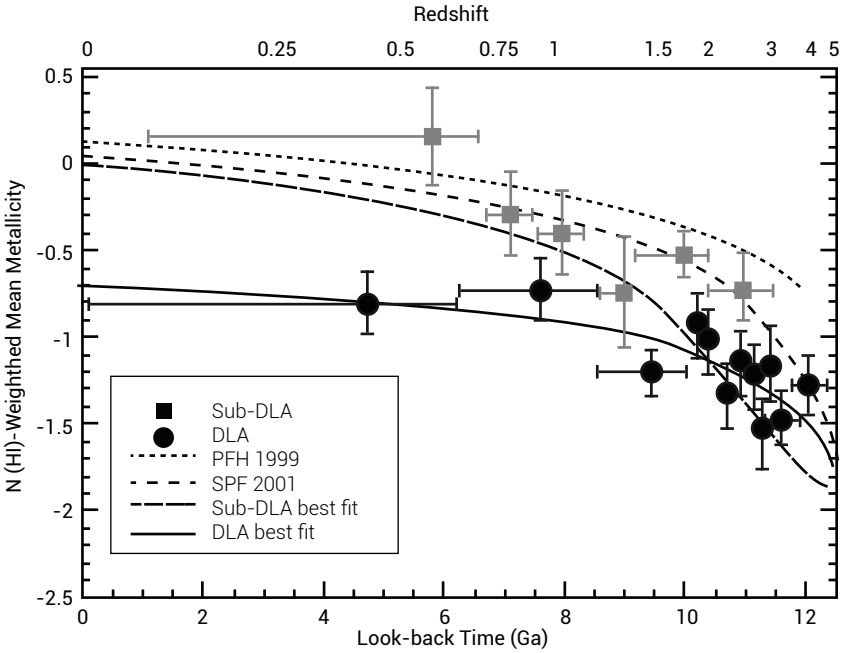


Figure 1. N(H I) column density weighted mean metallicity vs redshift and alleged look-back time (in Ga) for two types of galaxies, one metal rich (Sub DLA's) and the other metal deficient (DLA's). Zero metallicity (logarithmic scale) is that of the sun.[9] Formally, log N(H I) is estimated from ratios of species X/Y in the source compared to that of the sun. For example, log (NFe/NH)star – log (NFe/NH)sun.

But how much credibility do we give to these types of measurements? For example, figure 11 of Som *et al.* (2013),[9] reproduced here as figure 1. Can we accept that those data are correctly interpreted from the astronomical observations?

In a creation model I have written of a scenario with God creating from the beginning of Day 4 to the end of Day 4, but creation processes occurring throughout Day 4 and distributed spatially throughout the universe.[10] So we should not expect such a simple trend line as that exhibited in figure 1 (see figure 1 of ref. 10, reproduced here as figure 2).

As mentioned in the latter, there would be expected both mature and immature galaxies at all redshifts. Redshift may in some cases correlate with distance but not necessarily so. Hence, in the scenario I suggested there may be a weak trend but you would need to look at a lot of galaxies to determine if that is so. You would also have to make some important assumptions about metallicity and how it develops over the lifetime of the galaxy or quasar in question. You would also need to understand where quasars fit in as astronomical objects.[11,12]

And according to the Hubble Deep Field observations, galaxy morphology is very mixed at extremely high redshift, not a simple pattern of the more distant the more immature (and hence less metals). Also, very few galaxies (apart from quasars) have had their metallicity measured and the Som *et al.* paper relies on relatively few

quasar-backlit absorption clouds for their trend line (see figure 1).

In more recent developments both Humphreys and myself have started to look at models where there is no cosmological redshift, based on the notion that the universe is not expanding. But this idea does not necessarily mean that redshift should not vary with distance nor does it rule out a metallicity-redshift dependence *per se*.

Even if we could disprove categorically Hubble expansion of the universe, a Hubble-type law relating redshift to distance in a static universe is possible. One researcher has now proposed over 59 possible redshift mechanisms and most do not involve an expanding universe.[13]

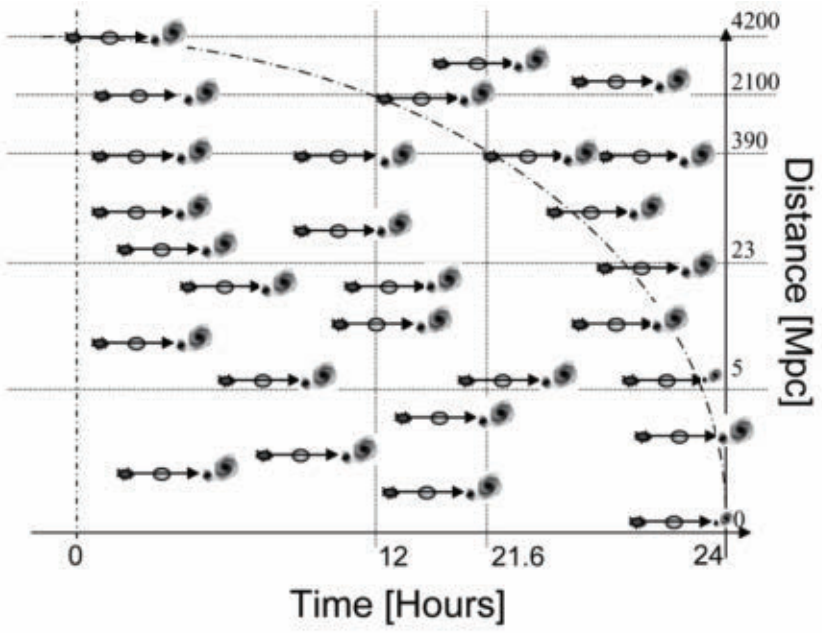


Figure 2. A simplified schematic representing some key features of the creation model timeline of Day 4. Distance is in Mpc on a base 10 logarithmic scale and time is in hours on an approximately linear scale. The objects represent ejection episodes where a quasar is ejected from a parent galaxy. The quasar subsequently evolves into a galaxy over about 300 million astronomical years, which is about half an hour or 2% of Day 4. The lengths of the arrows are exaggerated and should be 0.5 hours (by Earth clocks) long. Millions of such episodes occurred during Day 4.

Expected source distance-related redshifts under the Arp hypothesis

Now there may well be a metallicity dependence on distance but let's now focus closely on what I have proposed. I believe the observations of Halton Arp and others suggest to us a possible creation scenario that was ongoing during Day 4 of Creation Week and that all astrophysical objects outside 6,000 light-years distance from the solar system are a result of God's creative hands (Psalms 8:3, Psalms 19:1).[14] I have stated this in various papers.[10,15,16] This may or may not mean we directly observe events within Creation Day 4. If not, we observe events only shortly after the close of Creation Day 4 and Creation Week.

I quote here from a 2012 paper by Fulton and Arp.[17]

> "The standard model posits that the Lyα Forest is generated en route as radiation from a quasar passes through intervening galaxies leading to absorption at redshifts lower than the emission redshift of the quasar. The test of the theory comes from the redshifts distributed en route, which should match the distribution of intervening structures. McDonald *et al.* (2006) have recently conducted a detailed analysis of a large sample of high-redshift SDSS quasar spectra. They started from the raw spectral data in order to closely monitor sources of contamination not previously considered, the ultimate result being not only in support of the standard model of cosmology, but also useful in producing better models of the intervening structures. This has since been confirmed at high significance by Slosar *et al.* (2011)."

This is the standard model approach and it involves standard model assumptions. The primary one is that quasars are at their redshift distances and that they are the most distant objects in the universe. But work by Halton Arp, Jayant Narlikar, Geoffrey and Margaret Burbidge, and several others indicates otherwise.[18] They proposed that quasars are the embryonic galaxies, born with some intrinsic redshift (not related to distance), ejected from the hearts of parent galaxies.

> "On the other hand, the intrinsic redshift hypothesis posits that the Lyα Forest comes from absorption in the quasar itself, presenting the question of how the forest arises. The variable mass hypothesis (Narlikar & Das 1980) would predict lower particle masses at younger age and therefore higher redshifts. If one is arguing for periodic (quantized) redshifts, then one would expect that after transforming to the rest frame of the host galaxy redshifts that the absorption line redshifts should show up at Karlsson values. This idea can be tested with the large databases available now, such as our investigation of the 2dF data."[17]

This means that the intrinsic quasar redshifts fall at certain quantized values, for example, $z_K = 0.060$, 0.302, 0.598, 0.963, 1.410, 1.960, etc. And in relation to observations of absorption systems, Fulton and Arp (2012) explain it.

> "One then argues that a galaxy has multiple creation epochs and when light from a created quasar comes to the observer, it passes through *clouds of matter created earlier than the quasar, so as to have lower redshift than the quasar, thus producing absorption redshifts*. So, one testable prediction that can distinguish the Standard Model from our hypothesis is the distribution of absorption features in the Lyα Forest. In contrast to the Standard Model, our hypothesis predicts that absorption features *will be distributed at Karlsson values*. We propose that detailed observations and investigations could be made of the galaxy–quasar systems identified by our detection algorithm, using quasars at higher redshift that display the Lyα Forest, to ascertain if the redshifts of quasar absorption features are consistent with Karlsson redshifts, thus categorically distinguishing our hypothesis from the Standard Model [emphasis added]."[17]

In other words, it does not follow necessarily that quasar redshifts indicate distance and hence time according to the big bang theory.

> "If quasars are physically associated with a parent galaxy, the redshift of each quasar must be transformed to the reference frame of the putative parent as per Narlikar & Arp (1993) using
>
> $$(1+z_0) = (1+z_c)/(1+z_p), \quad (1)$$
>
> where z_0 is the transformed quasar redshift, z_c is the observed companion quasar redshift, and z_p is the observed redshift of the associated parent object that, by hypothesis, is the ejecting galaxy… The transformed redshift, z_0, of the candidate companion object is then hypothesized to be associated with the closest Karlsson redshift, z_K, so that the redshift velocity, z_v—the putative velocity of ejection away from the parent object—can be obtained from the formula (Narlikar & Arp 1993)
>
> $$(1+z_v) = (1+z_0)/(1+z_K)."[17] \quad (2)$$

For example, let us assume that these absorption features have intrinsic redshifts and let us use three examples from Som *et al.*[9] We don't know the redshift z_p of any putative parent galaxy that may have ejected the material, so we assume $z_p = 0$ for the moment. Then only Eq. (2) concerns us to transform the cloud into the reference frame of the unknown parent galaxy. We assume the features are associated with the absorbing cloud with intrinsic redshifts as $z_K = 1.410$ (as per Karlsson) for the absorber $z_{abs} = 1.518$ and $z_K = 1.960$ for those with $z_{abs} = 2.082$ and $z_{abs} = 2.139$. From this we get:

$$(1+z_v) = (1+1.518)/(1.410) = 1+0.045, \quad (3a)$$

$$(1+z_v) = (1+2.082)/(1.960) = 1+0.041, \quad (3b)$$

$$(1+z_v) = (1+2.139)/(1.960) = 1+0.060, \quad (3c)$$

This implies $z_v < 0.045$, 0.041 and 0.06 since we have not transformed into the reference frame of the original parent galaxy. And if the velocity of ejection (z_v) was zero these redshifts would represent that of the parent galaxies of $z_p = 0.045$, 0.041 and 0.060, respectively. The latter are the only possible Hubble law distance-related redshifts, under the Arp model. We would in reality expect z_p to be smaller than these allowing for a small ejection velocity component, $z_v \sim 0.01$.

Conclusion

The point is this. The clouds have large intrinsic, non-distance-related redshifts. Hence the calculations of metallicity verses distance (from redshifts) would need to be totally reassessed. And the trend would be most definitely lost, if it existed before, because there is no direct association of the intrinsic redshift of a quasar or a cloud with its parent galaxy redshift. Even in the three examples shown here, there is no correspondence between z_{abs} and z_p from these calculations.

Therefore a lot more needs to be investigated before one can truly say that a systematic trend in metallicity with a Hubble-law distance-related redshift exists. In fact, because this alternate interpretation of the same observational data results from a different underlying cause, one may never be able to definitely say what the truth is, this side of heaven.

Acknowledgements

An anonymous reviewer provided an excellent critique of an earlier draft of this article, which much improved the outcome.

References

1. Formally the metal content of a star, denoted by Z, is the combined mass fraction of all elements heavier than helium.
2. What is a metal-poor galaxy?, ned.ipac.caltech.edu/level5/Kunth/Kunth1.html
3. Reddy, N.A., Erb, D.K., Pettini, M., Steidel, C.C. and Shapley, A.E., Dust obscuration and metallicity at high redshift: New inferences from UV, Hα, and 8 μm observations of z ~ 2 star-forming galaxies, *Astrophysical J.* **712**:1070, 2010.
4. "While there is a systematic trend of decreasing metal abundance with increasing redshift at higher redshifts leading to depletions … there also appear to be systems with comparably low metal abundances at lower redshift … so that significant variations at a given epoch may exist." Excerpted from J.M. Shull and H.A. Thronson, Jr, *The Environment and Evolution of Galaxies*, Kluwer Academic Publishers, The Netherlands, p. 220, 1993.
5. Lisle, J., Anisotropic Synchrony Convention—A Solution to the Distant Starlight Problem, *Answers Research J.* **3**:191–207, 2010; cdn-assets.answersingenesis.org/doc/articles/pdf-versions/anisotropic_synchrony_convention.pdf.

6. Hartnett, J.G., The Anisotropic Synchrony Convention model as a solution to the creationist starlight-travel-time problem, *Creation* **25**(3): 56–62, 2011; creation.com/images/pdfs/tj/j25_3/j25_3_56-62.pdf.
7. Hartnett, J.G., *Starlight, Time and the New Physics*, Creation Book Publishers, 2007.
8. Humphreys, R., New time dilation helps creation cosmology, *J. Creation* **22**(3):84–92, 2008.
9. Som, D., Kulkarni, V.P., Meiring, J., York, D., P´eroux, C., Khare, P. and Lauroesch, J.T., Element Abundances at High-redshift: Magellan MIKE Observations of sub-Damped Lyman-α Absorbers at $1.7 < z < 2.4$, Mon. Not. R, *Astron. Soc.* 2013, arxiv.org/pdf/1307.7103v1.pdf.
10. Hartnett, J.G., Creative episodes in a creationist cosmology, *J. Creation* **19**(3):108–115, 2005; creation.com/images/pdfs/tj/j19_3/j19_3_108-115.pdf
11. Hartnett, J.G., What do quasars tell us about the universe? johnhartnett.org/2014/05/10/what-do-quasars-tell-us-about-the-universe/.
12. Any consideration of metallicity depends on the assumptions made about the development of quasars and other astronomical objects. Note: For stars other than the sun the abundances of the elements are not generally so well known nor are they easily measured. Hence the iron-to-hydrogen ratio (Fe/H) is often used as a proxy to measure the 'metallicity' of stars. And thus it is also assumed that the other heavy element concentrations are in the same proportion to iron as found in the sun. The reason for the large variation in metal content, Z, of stars is that the heavy elements are not considered to be primordial. Only hydrogen and helium (and very small quantities of lithium) are alleged to have formed in the big bang. All other elements were allegedly synthesized in the nuclear reactions that take place in the centres of stars. This processed material is eventually returned to the interstellar medium by stellar mass loss, of which the most dramatic example is a supernova explosion. Thus the interstellar medium is continually being enriched with 'metals'. Therefore it follows that young stars that have 'recently' formed from the constituents of the interstellar medium will have large Z.
13. Marmet, L., On the Interpretation of Red-Shifts: A Quantitative Comparison of Red-Shift Mechanisms, 23 July 2014, www.marmet.org/cosmology/redshift/mechanisms.pdf.
14. In some sense that is self-evident. It is all the work of the Creator. The main uncertainty is how a time has passed, in what we observe, since the close of Creation Day 4?
15. Hartnett, J.G., The heavens declare a different story! *J. Creation* **17**(2):94–97, 2003; also johnhartnett.org/2014/05/03/the-heavens-declare-a-different-story/.
16. Hartnett, J.G., Galaxy-quasar associations, johnhartnett.org/2014/01/01/galaxy-quasar-associations/.
17. Fulton, C.C. and Arp, H.C., The 2dF redshift survey. I. Physical association and periodicity in quasar families, *Astrophysical J.* **754**:134–143, 2012.
18. Hartnett, J.G., Halton Arp—Big-bang-defying giant passes away, creation.com/halton-arp-dies.

A preliminary age calibration for the post-glacial-maximum period

Tas Walker

In the last twenty years a number of studies have been published on the rise in global sea level since the last glacial maximum. The dates of the last glacial maximum and the change of sea level with time were based on long-age dating assumptions using a variety of methods, and fitted into the uniformitarian timeline.[1] Given that the glacial maximum occurred toward the end of the post-Flood Ice Age, these curves allow us to develop an age calibration to convert secular, long-age dates into dates within biblical history.

Developing the calibration curve

Figure 1 shows the current secular view on sea-level rise since the end of the last glacial maximum. This graph was prepared by Robert Rohde from several published papers[2] that included data assembled from numerous other sources. The actual sea levels had been adjusted for vertical geologic motions such as continental rebound, connected with the removal of continental ice, and hydrostatic rebound, due to the increased weight of water in coastal areas. However, it is the dates on the chart rather than the sea levels that are primarily needed for an age calibration. An analysis of the magnitude of the sea-level fall needs to be evaluated, but this is outside the scope of this article. The graph shows the last glacial maximum occurring at 22,000 years ago, when sea level was at its lowest, and the sea-level rise reaching the present level at about 7,000 years ago, all within the secular timescale.

It was the biblical Flood that provided the conditions on Earth that caused the Ice Age immediately after the Flood. The primary driver was warm oceans and a secondary factor would have been volcanic dust and aero-sols high in the atmosphere.[3] In his monograph on this topic Oard discusses the timing of the Ice Age, namely the time to reach glacial maximum, and the time for the ice sheets to melt back to their present size.

His 'best estimate' for their build-up to glacial maximum, based on a 25% depletion of solar radiation and a 12.5% decrease in the current values of the atmospheric and oceanic heat transports, is 500 years.[4] From energy balance considerations he found only a short time was required for the oceans to cool, and the ice sheet to melt back. The periphery of each sheet would melt first, and quickly, and the interiors more slowly. He concluded that the best estimate for the melt-back time to present size was 200 years.[5]

The timing of the Ice Age is tied to the timing of the Flood, which, in round figures, can be taken as about 4,500 years ago.[6] The Ice Age maximum would thus have been about 4,000 years ago and the oceans would have reached their current level about 3,800 years ago. Hence we equate the secular date

Table 1. Calibration points and factors for post-glacial-maximum period.

Point	Secular Date (ka)	Biblical Date (ka)	Calibration Factor
Present time	0	0	1.00
End of Ice Age	7,000	3,800	0.5429
Ice Age maximum	22,000	4,000	0.1818

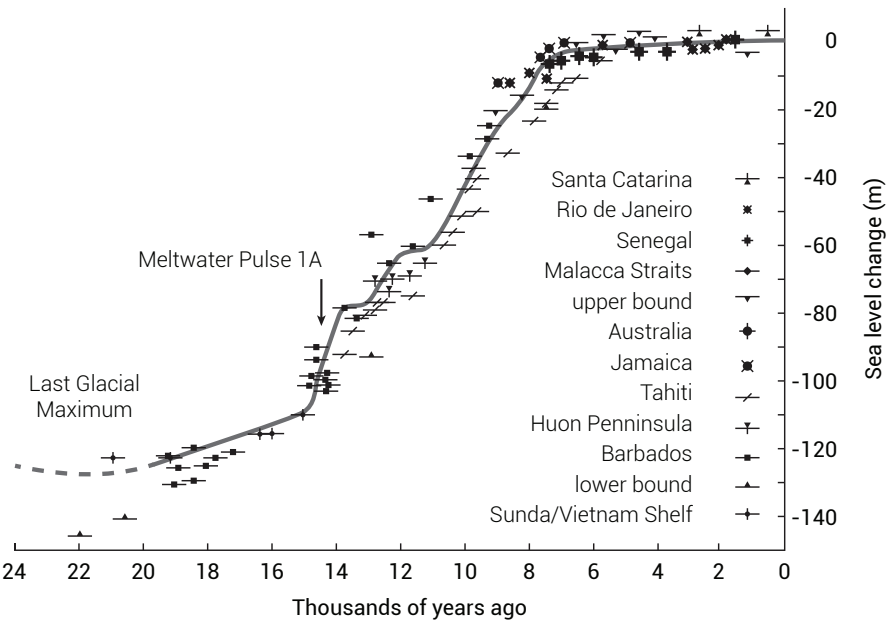


Figure 1. Long-age uniformitarian sea-level curve for the post-glacial-maximum period (after Rohde[2]).

for the last glacial maximum (22 ka ago) to the biblical date of 4,000 years ago. And we tie the secular date when the oceans reached their present level (7 ka ago) to the biblical age of 3,800 years ago. The 200-year period of ice melt-back results in a very tight compression of the major part of the secular timescale. This gives us three points for our calibration curve (table 1).

We would expect the secular dates to better match historical dates (and thus biblical dates) for recent history over the last 2–3 ka, and for the calibration factor to be close to 1.0 in this range. Further, we would expect the separation between the two scales to increase with increasing age due to the effects of the Flood and the Ice Age, and thus the calibration factor would diverge more greatly from 1.0. As the secular time increased into multiple tens of thousands of years we would expect the calibration factor to become smaller and smaller, tapering off into an exponential decay type of shape. Based on this we can fit by eye a reasonable calibration curve for the period, as shown in figure 2.

From the calibration factors of figure 2 we can calculate a calibration curve as shown in figure 3, which allows us to read the biblical age for the post-glacial-maximum period when we have the uniformitarian age.

Discussion

This is a broad-brush approach to adjusting secular dates to fit in with ages based on the historical reports in the Bible. It may be claimed that the method is circular, that we have massaged the figures to get the answer that we want. This is correct, but this is the way that all dating methods work.[7] Every method begins with the researcher making careful measurements on samples in the present. Then he needs to make assumptions about the past, before he can calculate an 'age'. But he does not stop there. He will then compare his result with other age information, and adjust his assumptions and interpretation until his age makes sense within its context. So, this exercise of converting secular ages to match biblical history simply follows the normal practice of geochronology, but with the great advantage that biblical history is reliable.

The carbon-14 (C^{14}) method is the one most widely used for the period of time back to about 40,000 years ago, and so this calibration curve would reflect the sorts of adjustments that would need to be made to C^{14} 'dates' in order to obtain actual dates. The need for significant correction to C^{14} dates beyond a few thousand years has been long recognized even by secular geochronologists, as Pilcher discusses:

> "It is most likely that at the end of the last glaciation there were considerable perturbations of the global carbon cycle with the release of old carbon from ice, and an increase in biomass as temperatures rose. … It is hard to believe that these changes would not have had dramatic effects on the radiocarbon levels in the atmosphere."[8]

Secular geochronologists already have calibration curves for the C^{14} method to make the results agree with other methods and other information, such as dendrochronology. However, we would anticipate even larger cor-rections would be needed for C^{14} dating than those used by secular geochronologists because they ignore the dramatic effects of the Flood. The Flood would impact many factors, including non-equilibrium levels for C^{14} in the atmosphere immediately after the Flood, the burial of low C^{14} pre-Flood vegetation, increased volcanism after the Flood producing 'old carbon' in the atmosphere, revegetation of the earth after the Flood, and changes to the earth's magnetic field affecting C^{14} production in the upper atmosphere. A useful discussion of the factors affecting C^{14}dates as they would have been impacted by the biblical Flood and

the post-Flood recovery is presented by Batten.[9]

Conclusion

The calibration curve (figure 3) would have general application to all dates published within the secular long-age scheme because all dating methods are compared with, and calibrated against, each other in order to obtain a consistent suite of dates. While figure 3 can be considered a general calibration curve, we would anticipate that there would be temporal and regional anomalies depending on the dating method and the study location. We will need to consult more reliable sources and obtain other information in order to refine and test the curve.

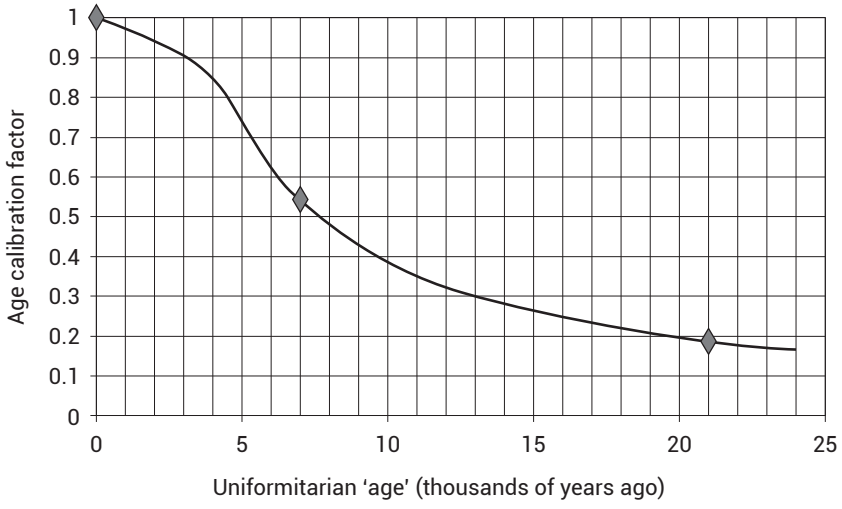


Figure 2. Fitted calibration factors to convert uniformitarian 'age' to biblical age for the post-glacial-maximum period. Biblical age is obtained by multiplying the secular age by the relevant calibration factor. Diamonds are calibration points from table 1.

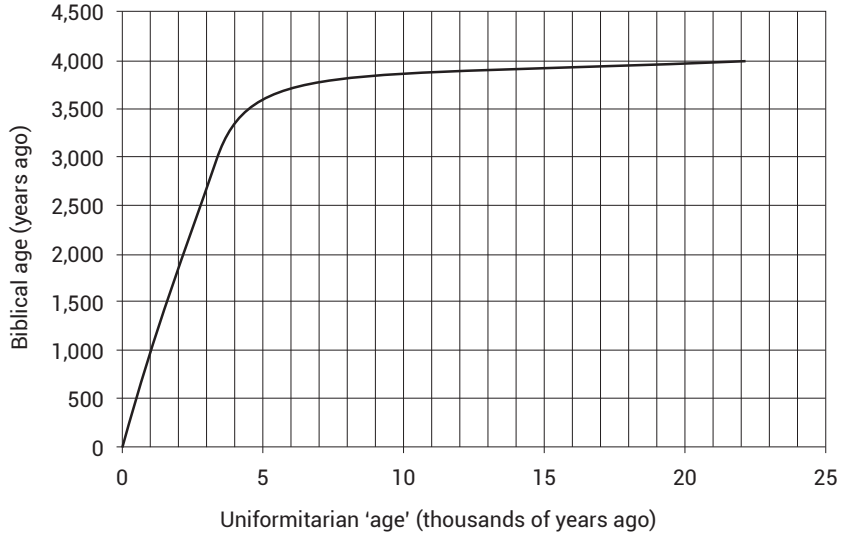


Figure 3. Calibration curve to convert secular, long-age 'dates' to biblical dates for the post-glacial-maximum period. Biblical age is obtained from the secular age by reading from the graph.

References

1. Yokoyama, Y., Lambeck, K., De Decker, P., Johnston, P. and Fifield, L.K., Timing of the Last Glacial Maximum from observed sea-level minima, *Nature* **406**:713–716, 17 August 2000.
2. Rohde, R., Post-glacial sea level, Global Warming Art, www.globalwarmingart.com, accessed 24 July 2014. Rohde collated information from:
   1. Fleming, K., Johnston, P., Zwartz, D., Yokoyama, Y., Lambeck, K. and Chappell, J., Refining the eustatic sea-level curve since the Last Glacial Maximum using far-and intermediate-field sites, *Earth and Planetary Science Letters* **163**(1–4):327–342, 1998.
   2. Fleming, K.M., Glacial Rebound and Sea-level Change Constraints on the Greenland Ice Sheet, Australian National University, PhD Thesis, 2000.
   3. Milne, G.A., Long, A.J. and Bassett, S.E., Modelling Holocene relative sea-level observations from the Caribbean and South America, *Quaternary Science Reviews* **24** (10–11):1183–1202, 2005.
3. Oard, M.J., *An Ice Age Caused by the Genesis Flood*, Institute for Creation Research, El Cajon, CA, 1990.
4. Oard, ref. 3, pp. 93–98.
5. Oard, ref. 3, pp. 114–119.
6. Hardy, C. and Carter, R., The biblical minimum and maximum age of the earth, *J. Creation* **28**(2): 89–96, 2014, conclude that the Flood probably occurred between 2600 BC and 2300 BC.
7. Walker, T., How dating methods work, *Creation* **30**(3):28–29, 2008; creation.com/how-dating-methods-work.
8. Pilcher, J.R., Radiocarbon dating; in: Smart, P.L. and Frances, P.D. (Eds.), *Quaternary Dating Methods—A User's Guide*, Quaternary Research Association, Technical Guide No. **4**, Cambridge, pp. 16–32, 1991.
9. Batten, D. (Ed.), *The Creation Answers Book*, (4th edn.) Creation Book Publishers, pp. 68–73, 2012.

Ice Age megafloods provide insight into Flood sedimentation

Michael J. Oard

As soon as uniformitarianism was introduced to geologists by the publication of Lyell's *Principles of Geology* from 1830 to 1833, it was intellectually assaulted by the discovery of the Ice Age. Since massive ice sheets no longer cover northern North America, northwestern Eurasia, and many of the mountains of the world, their existence greatly surprised the advocates of the uniformitarian principle:

> "The most important point about the controversy over the Ice Age was that any such episode in the geologically recent past was *totally unexpected* by leading geologists of all stripes: by Buckland no less than by Lyell, to mention just two representative figures [emphasis original]."[1]

The uniformitarian principle was again challenged in the 1920s and 1930s by the discovery of the Lake Missoula flood.[2,3] This flood was a result of a giant Ice Age meltwater lake that was up to 600 m deep, trapped in the valleys of western Montana, USA.[4] The ice dam holding it back in northern Idaho broke and the floodwater rushed over eastern Washington and northern Oregon. The water was up to 300 m deep and moved at a pace of over 125 km/h through the Columbia Gorge between Washington and Oregon.[5] Because of the adherence to uniformitarianism, the concept of the Lake Missoula flood was rejected for 40 years. This was in spite of many years of carefully collected field evidence by J Harlen Bretz. Scientists considered Bretz's 'outrageous hypothesis' too biblical in nature.[6,7] This shows the blinding effect that the assumption of uniformitarianism had in the past and still has on the minds of many secular scientists.[8] It would be surprising if most secular scientists could see evidence for the Genesis Flood in the field, considering the mental block their key assumption creates.

Uniformitarianism, the basic assumption of geology, was again assaulted in the late 1960s and early 1970s when the scientists learned that many circular features found on all of the solid bodies of the solar system were due to impacts and not volcanism.[9,10] These many impacts indicate a past rate of cratering much greater than today; it was easier to believe in volcanic eruptions that are common on the Earth.

Many more Ice Age megafloods

Ever since the acceptance of the Lake Missoula flood, scientists have found evidence for other Ice Age megafloods. Victor Baker catalogued 41 such floods in North America, Eurasia, and southern South America.[11] Carling states:

> "There is growing recognition that sedimentary deposits related to high-energy, large-scale, freshwater floods are widespread across the continents and, in the main, can be related to Quaternary [Ice Age] outbreak flows from ice-dammed lakes."[12]

These megafloods do not include megafloods that may have issued forth from under the ice sheets, as advocated by John Shaw and colleagues.[13] Most glaciologists reject Shaw's ideas, mainly because they do not know of a source of water within the area bounded by the ice sheets.

Megafloods cause rapid, layered sedimentation

Megaflood sedimentation shows just how fast layers can form. In depositional areas, usually slackwater valleys, and not including large bars, the sediments from megafloods rapidly formed multiple layers. These layers are commonly called rhythmites. They

Figure 1. Lake Missoula flood rhythmites from the Yakima River Valley, Washington, USA. Notice the white volcanic ash layer from Mount St Helens near the top of the rhythmites (arrow). The rhythmites are mildly deformed from slumping along the edge of a cliff above the Yakima River.

were formed quickly by waning and waxing flow. A rhythmite is a repeating sequence of two or more sedimentary layers. The waxing and waning flow is caused by pulses of water resulting from the convergence and divergence of water, especially in anastomosing flow,[11] which forms branching and reconnecting channels. The Lake Missoula flood was an anastomosing flow since it spread to a width of 160 km over eastern Washington with numerous channels until entering a newly formed lake, 245 m deep, in the Pasco Basin. The temporary lake formed because the water could not drain through Wallula Gap as fast as it was entering the lake. It is likely that convergent and divergent flow would cause waves on this lake that would have pulsed up the tributary valleys of the Pasco basin. Many rhythmites formed quickly (figure 1). Some geologists believe that the 40 rhythmites observed in these tributary valleys to the Pasco Basin were formed by pulses in one large flood.[14]

Dozens of Lake Missoula floods questionable

Rapid formation of multiple rhythmites in a giant flood was demonstrated in a 1996 Icelandic subglacial flood. As the flood issued from underneath the ice cap, it spread into a small slackwater embayment and quickly formed rhythmites along with other sediments.[15,16] Although the flow rate was only 0.2% of the Lake Missoula flood, this Icelandic flood managed to deposit 200 planar rhythmites and other sedimentary layers 15 m deep in just 17 hours! The rhythmites were formed by short-period pulses of water that waxed and waned.[17] The Lake Missoula flood eroded about 200 km^3 of basalt and silt in eastern Washington and deposited the sediments over a wide area, especially in expansion bars. The 30–40-m-thick deposit of rhythmites that formed within the tributary valleys of the Pasco Basin are about the thickness one would expect from a single Lake Missoula flood. Taking into account the data on the Icelandic flood sedimentation, it is questionable how each rhythmite in the Lake Missoula flood could be a separate flood, as many geologists still claim. It was a volcanic ash layer in the rhythmites that spawned the multiple floods theory. There is much more evidence that supports the Lake Missoula flood being only one and not many floods.[2,3,16,18]

Some geologists believe that there were 90 or more Lake Missoula floods at the peak of the 'last' ice age. This was based on rhythmites from the Sanpoil Valley of north central Washington. However, John Shaw and colleagues found strong evidence that these rhythmites were not from numerous Lake Missoula floods.[19] They determined this because they found no basalt fragments in the rhythmites that are located only 10 km north of the Columbia River Basalts. The Lake Missoula flood would have had to travel over the basalt outcrops, transporting fragments up the Sanpoil Valley to deposit rhythmites. Instead, it appears these particular rhythmites were probably generated by annual melting and sedimentation from a finger of the Cordilleran Ice Sheet that lay just to the north in the Sanpoil Valley.

How is the ash layer in the rhythmites explained?

The main evidence for the multiple floods theory is a volcanic ash layer, thought to be from Mount St Helens,[20] that was found near the top of one of the rhythmite sequences, as shown in figure 1 (arrowed). An eruption of Mount St Helens was claimed to be too rare an event to have left a record in the sediments of one flood that lasted only a week. The ash layer was therefore thought to have been deposited on bare ground on top of a rhythmite, suggesting that each rhythmite was a separate flood, separated by dozens of years. It is a reasonable argument and practically all geologists have believed it.

However, evidence now exists in the literature that would connect these two events.[21] It has been demonstrated that the filling of a reservoir can cause weak to strong earthquakes. For instance, the slow impoundment of water behind Koyna Dam in India caused numerous earthquakes, one a magnitude 6.3 earthquake that killed 200 people.[22,23] It is suggested that the filling of the new Zipingpu Dam in China caused the great magnitude 7.9 earthquake in Sichuan that killed 80,000 people.[23,24] The filling of reservoirs on the upper Yangtze River in China is believed by some scientists to have caused a magnitude 6.5 earthquake that killed more than 600 people.[25]

A strong connection between earthquakes and volcanoes or magmatism has been shown by many investigators.[26–29] Simpson stated:

> "The geophysics reported in the Oct. 29 NATURE that 8 of the study's 204 earthquakes of magnitude 8.0 or greater seemed to trigger *same-day* eruptions within 750 km (emphasis mine)."[26]

Such a statistical relationship is significant, given the rarity of the events. However, the volcanoes that did erupt were those which were already giving indications that an eruption might occur.[30]

Mount St Helens is one of the most active volcanoes in North America; it erupts about every 125 years. It is only 240 km west of the centre of the lake in Pasco Basin. Instead of taking years to fill, this lake became 245 m deep within a few days. It seems reasonable that such a weight of water could have triggered earthquakes strong enough to cause Mount St Helens to erupt, spreading the ash eastward in the prevailing upper winds. The location of the ash layer near the top of the rhythmites, which incidentally thin upward, is about what would be expected if it were the result of a chain of events initiated by the Missoula flood.

Implications for Flood geology

Sedimentation in slackwater areas of Ice Age megafloods and the subglacial flood from an Icelandic ice cap provide insights into sedimentation during the Genesis Flood. Megaflood sedimentation shows just how quickly sediments can be deposited and layered in areas where current velocity decreases. Layers form naturally in moving water by the deposition of particles of different sizes and densities.[31] Uniformitarian scholars have been of the opinion that the sedimentary rocks on the continents were too thick to have formed quickly in the Genesis Flood.[32] However, observations of megafloods show that an event such as the Genesis Flood would be capable of depositing all the sedimentary rocks. If the Lake Missoula flood was magnified into a deluge covering the whole Earth, combined with the turbulence caused by the Earth's rotation and other recorded events, it is not difficult to see the potential of depositing the estimated average of 1,800 m[32] of layered sedimentary rocks on the continents.[33]

It has been observed that rhythmites resemble a series of turbidites, the depositional product of turbidity currents.[34] Turbidites represent a significant proportion of total sedimentary rock strata, and are assumed to have been deposited in submarine downslope mass movements. Although turbidites generally consist of fining-upward sediments, there are many complications and missing layers in the classical turbidite models.[35] The concept of turbidites is itself vague and frequently an oversimplification.[36] The similarity to rhythmites raises the possibility that features identified as 'turbidites' may simply be the depositional result of waxing and waning currents, instead of, or in addition to, downslope movement of sediments. The waxing and waning currents that produced the rhythmites in Iceland and in the Lake Missoula flood would have been a common occurrence during the Genesis Flood and it is possible that they could have accounted for the turbidites in sedimentary rock layers.

Reference

1. Rudwick, M.J.S., *Worlds Before Adam: The Reconstruction of Geohistory in the Age of Reform*, The University of Chicago Press, Chicago, IL, pp. 550–551, 2008.
2. Oard, M.J., *The Missoula Flood Controversy and the Genesis Flood*, Creation Research Society Books, Chino Valley, AZ, 2004.
3. Oard, M.J., *The Great Missoula Flood: Modern Day Evidence for the Worldwide Flood*, Awesome Science Media (DVD), Canby, OR, 2014.
4. Smith, L.N., Stratigraphic evidence for multiple drainings of glacial Lake Missoula along the Clark Fork River, Montana, USA, *Quaternary Research* **66**:311–322, 2006.
5. Benito, G. and O'Connor, J.E., Number and size of last-glacial Missoula floods in the Columbia River valley between the Pasco Basins, Washington, and Portland, Oregon, *GSA Bulletin* **115**(5):624–638, 2003.
6. Alt, D., *Glacial Lake Missoula and its Humongous Floods*, Mountain Press Publishing Company, Missoula, MT, p. 17, 2001.
7. Allen, J.E. and Burns, M., with Sargent, S.C., *Cataclysms on the Columbia*, Timber Press, Portland, OR, p. 44.
8. Because of the assaults on uniformitarianism, geologists now accept a few catastrophes, but essentially uniformitarianism rules and is the basis for secular earth science.
9. Marvin, U.B., Impact and its revolutionary implications for geology; in: Sharpton, V.L. and Ward, P.D. (Eds.), *Global Catastrophies in Earth History: An Interdisciplinary Conference on Impacts, Volcanism, and Mass Mortality*, GSA Special Paper 247, Geological Society of America, Boulder, CO, p. 147, 1990.
10. Oard, M.J., An impact Flood submodel—dealing with issues, *J. Creation* **26**(2):73–81, 2012.
11. Baker, V.R., Global late Quaternary fluvial paleohydrology with special emphasis on paleofloods and megafloods; in: Wohl, E.E. (Ed.), *Treatise in Fluvial Geomorphology*, Elsevier, New York, 2013.
12. Carling, P.A., Freshwater megaflood sedimentation: what can we learn about generic processes? *Earth-Science Reviews* **125**:87, 2013.
13. Shaw, J., In defence [sic] of the meltwater (megaflood) hypothesis for the formation of subglacial bedform fields, *J. Quaternary Science* **25**(3):249–260, 2010.
14. Carling, ref. 12, p. 102.
15. Russell, A.J., and Knudsen, O., An ice-contact rhythmite (turbidite) succession deposited during the November 1996 catastrophic outburst flood (jökulhlaup), Skeidarájökull, Iceland, *Sedimentary Geology* **127**:1–10, 1999.
16. Oard, M.J., Only one Lake Missoula flood, *J. Creation* **14**(2):14–17, 2000.
17. Carling, ref. 12, pp. 102–103.
18. Oard, M.J., Further evidence of only one large Lake Missoula flood, *J. Creation* **26**(3):3–4, 2012.
19. Shaw, J., Munro-Stasiuk, M., Sawyer, B., Beanery, C., Lesemann, J.-E., Musacchio, A., Rains, B. and Young, R.R., The Channeled Scabland: back to Bretz? *Geology* **27**(7):605–608, 1999.
20. Mullineaux, D.R., Wilcox, R.E., Ebaugh, W.F., Fryxell, R. and Rubin, M., Age of the last major scabland flood of the Columbia Plateau in Eastern Washington, *Quaternary Research* **10**:171–180, 1978.
21. Oard, ref. 2, pp. 50–52.
22. Gupta, H,K., Radhakrishna, I., Chadha, R.K., Kümpel, H.-J. and Grechsch, G., Pore pressure studies initiated in area of reservoir-induced earthquakes in India, *EOS, Transactions of the American Geophysical Union* **81**(14):145, 151, 200.
23. Kerr, R.A. and Stone, R., A human trigger for the great quake of Sichuan? *Science* **323**:322, 2009.
24. Kerr, R.A. and Stone, R., Two years later, new rumblings over origin of Sichuan quake, *Science* **327**:1184, 2010.
25. Qui, J., Chinese data hint at trigger for fatal quake, *Nature* **513**:154–155, 2014.
26. Simpson, S., Big shocks push volcanoes over the edge, *Science News* **154**:279, 1998.
27. Linde, A.T. and Sacks, I.S., Triggering of volcanic eruptions, *Nature* **395**:888–890, 1998.
28. Hill, D.P. *et al.*, Seismicity remotely triggered by the magnitude 7.3 Landers, California, earthquake, *Science* **260**:1617–1623, 1993.
29. Power, J.A., Moran, S.C., McNutt, S.R., Stihler, S.D. and Sanchez, J.J., Seismic response of the Katmai volcanoes to the 6 December 1999 magnitude 7.0 Karluck Lake earthquake, Alaska, *Bulletin of the Seismic Society of America* **91**:57–63, 2001.
30. Prejean, S.G. and Haney, M.M, Shaking up volcanoes, *Science* **345**:39, 2014.
31. Berthault, G., Experiments on stratification; in: Walsh, R.E. (Ed.), *Proceedings of the Third International Conference on Creationism*, technical symposium sessions, Creation Science Fellowship, Pittsburgh, PA, pp. 103–110, 1994.
32. Reed, J.K. and Oard, M.J., Three early arguments for deep time—part 3: the 'geognostic pile', *J. Creation* **26**(2):100–109, 2012.
33. This figure does not include the sediments and sedimentary rocks eroded off the continents during the Recessional Stage of the Flood and is now along the continental margin.
34. Carling, ref. 12, p. 87–113.
35. Middleton, G.V., Sediment deposition from turbidity currents, *Annual Review of Earth and Planetary Science* **21**:89–114, 1993.
36. Shanmugam, G., 50 years of the turbidite paradigm (1950s–1990s): deep-water processes and facies models–a critical perspective, *Marine and Petroleum Geology* **17**:285–342, 2000.

Here today …

Bryan V. Radford

In 1999 the Da'an Chi River in Western Taiwan was dammed by the vertical movement of a fault block. As the Da'an Chi River is subject to frequent flood events, the fault block was overtopped, leading to a substantial gorge being cut into the rock. The gorge has been the subject of intense investigation, which has revealed that the entrance to the gorge is being eroded at an unprecedented rate by a previously unobserved process. Such is the rate of erosion that in an estimated 50 years the gorge may well disappear without a trace.

Creation of the gorge

In 1999, an earthquake of magnitude 7.9, named the Jiji earthquake, occurred in Western Taiwan. A large block of rock was raised by 10 m during the earthquake. The fault line cut transversely across the Da'an Chi River, blocking the flow and creating a temporary reservoir.

The Da'an Chi River is subject to frequent and violent flood events. The barrage formed by the fault block was soon overtopped, and between 2004 and 2008 a gorge more than a kilometre long, 25 m wide and 17–20 m deep was cut into the rock. The unusual circumstances of the gorge's creation made it a valuable site for the study of gorge geomorphology. A team of scientists from the GFZ German Research Centre for Geosciences in Potsdam has been making an intensive study of the gorge using GPS measurements, time lapse photography and laser scans. The team leader, Dr Kristen Cook, explained the reason for the academic interest:

> "We have here the world's first real-time observation of the evolution of gorge width by fluvial erosion over the course of several years."[1]

It has been expected that development of the gorge would proceed by erosion of the walls, resulting in a gradual widening of the gorge. This process is indeed occurring, currently at the rate of about 1.5 m/yr. However, it was discovered that a previously unobserved process was eroding the entrance to the gorge at an unprecedented rate.

Downstream sweep erosion

When the Jiji earthquake occurred, the upthrust fault block placed a barrage across a previously existing wide flood plain. The subsequent creation of the gorge resulted in a situation in which flow down the flood plain was suddenly channelled into a narrow gorge. The resulting high flow velocities, coupled with the entrained bed load, causes substantial erosion of the entrance to the gorge. The effect is to reduce the length of the gorge from the upstream toward the downstream end at a rate of 17 m/yr. This erosional phenomenon has been named downstream sweep erosion.

> "We identify a mechanism, which we term downstream sweep erosion, that is rapidly transforming the gorge into a bevelled floodplain through the downstream propagation of a wide erosion front located where the broad upstream channel abruptly transitions into a narrow gorge. We estimate that gorge erosion will remove the uplifted topography in as little as 50 years."[2]

It is known that earthquakes occur in the same area as the Jiji earthquake every 300–500 years. Prior to the Jiji earthquake there was no indication that a gorge had previously existed in that area. Consequently, assuming similar uplifts have occurred in the past, the conclusion is that the existing gorge will be completely eradicated.

Gorge formation

The assumption of the GFZ team is that they are monitoring a scale model of much larger and slower processes.

> "The formation is known in Chinese as the Grand Canyon of the Daan River, and Dr Cook said it shows similarity to its mighty US namesake in Arizona.
>
> "'That's one of the exciting things—we expect the process to be the same, but sped up.'"[1]

The Da'an Chi River gorge was blocked in a very short time by a catastrophic event followed by rapid

Table 1. Observed gorge formation.[3,4,5]

Site	Initiator	Date	Gorge			Formation time
			Length	Width	Depth	
Canyon Lake, TX	Spillway overflow	July 2002	1.6 km (1 mi)	n/a	15 m (50 ft)	3 days
Mount St Helens	Volcanic eruption	May 1980	n/a	n/a	30 m (100 ft)	1 day
Southern Brazil	Rain storm	June 1974	500 m (1600 ft)	15 m (50 ft)	5 m (16 ft)	5 minutes
Walla Walla, WA	Flow diversion	March 1926	450 m (1500 ft)	n/a	35 m (120 ft)	6 days
Imperial Valley, CA	Levee failure	February 1905	69 km (43 mi)	300 m (1000 ft)	15 m (50 ft)	9 months

(presently ongoing) erosion of the barrier by large quantities of fast-flowing water. However, this may not be the process they have in mind for the Grand Canyon. No equivalent erosion event is known to have affected the Grand Canyon, so the comparison is tenuous. Apparently the value of the Da'an Chi Gorge is that an unexpectedly powerful erosional phenomenon is occurring on a timescale that in uniformitarian geological terms, is extremely short.

While the processes surrounding the Da'an Chi Gorge are certainly spectacular, they should not be particularly surprising. A number of erosional events have been observed to take place in a short time, all involving some kind of catastrophic process and large quantities of flowing water. A few notable examples are given in table 1.

There are, in addition, some much larger gorge-forming events which were not observed, but which have left behind enough evidence to show that they did indeed occur. These include:

- formation of the Channelled Scablands, probably in a matter of days, initiated by failure of the ice barrage holding back the vast waters of Lake Missoula[6–8]
- formation of the English Channel in an estimated several months, thought to have been initiated by overtopping of the Weald-Artois chalk ridge, which formerly spanned the Dover Strait, thereby releasing the water dammed between the chalk ridge in the south and glaciers to the north[9,10]
- the Lake Bonneville flood, which was initiated by breaching through a ridge, leading to draining of the lake in 2–12 months, accompanied by formation and/or extension of a number of canyons, the 180-m- (600-ft) deep Snake River Canyon among them.[11,12]

It is evident that vast stretches of time are not necessarily required for the formation of very impressive erosional features. The main requirement is a large volume of water and some event whereby it is suddenly released.

Gorge eradication

The expected eradication of the Da'an Chi River gorge by a previously unobserved process leads one to consider whether a general principle is indicated. It is dubious practice to generalize from a single example, especially one that is not expected to leave any lasting evidence of its existence. However, if there is a general principle, it might be something like:

Figure 1. The Da'an Chi River, showing the gorge that is being eroded at times of flood flow.

Disciplines that have been scientifically studied for decades or even centuries, can encounter previously unobserved and possibly ephemeral processes under novel circumstances.

In considering how such a principle might be applied, it becomes evident that it is of more use to uniformitarians than to creationists. This is because creationists, as a general rule, rely on observed data, moderated by their understanding of the biblical text, to formulate and, if necessary, modify their hypotheses. A prime example of this is the progressive development of a creationist cosmology by Dr Russ Humphries from first proposals,[13] via interaction with other creationist cosmologists,[14] to current thinking.[15]

Conversely, when, as so often happens, observed reality fails to match theoretical expectations, the uniformitarian response can be one of:

- ignore the data (e.g. ^{14}C in diamonds[16])
- defer consideration of the observations pending further research[17]
- explain the data away (e.g. explaining anomalous radiometric dates by 'resetting' of radiometric clocks by recrystallization—or any one of some 400 other documented[18] 'explanations')
- declare whatever is missing to be present but unobservable (e.g. dark matter[19] and paraconformities[20])
- invent a materialistic explanation, "no matter how counter-intuitive, no matter how mystifying to the uninitiated".[21]

The Da'an Chi Gorge phenomenon illustrates yet again that the natural world is replete with instances of processes that do not necessarily conform to the accepted scientific dogma of the day. Progress in science might be better served by open-minded consideration of the observations rather than by a rigid prior commitment to a particular philosophical position.

References

1. Science & Environment, *BBC News*, "Taiwan's 'vanishing canyon' erasing quake record", 18 August 2014.
2. Cook, K.L., Turowski, J.M. and Hovius, N., River gorge eradication by downstream sweep erosion, *Nature Geoscience*, Advance Online Publication, 17.08.2014, DOI: 10.1038/ngeo2224.
3. Austin, S.A., *Rapid erosion at Mount St Helens*, Institute for Creation Research, Technical Papers, El Cajon, CA, 1984.
4. Doyle, S., A gorge in three days! *Creation* **31**(3):32–33, 2007; creation.com/a-gorge-in-three-days.
5. Morris, J., A canyon in six days! *Creation* **24**(4): 54–55, 2002; creation.com/a-canyon-in-six-days.
6. Austin, S.A., Washington Scablands and the Lake Missoula Flood, Institute for Creation Research, www.icr.org/article/washington-scablands-lake-missoula-flood, 10 October 2005.
7. Oard, M.J., Evidence for Only One Gigantic Lake Missoula Flood; in: Ivey, R.L. (Ed.), *The Fifth International Conference on Creationism*, Creation Science Fellowship, Pittsburgh, PA, pp. 219–231, 2003.
8. Oard, M.J., *Only one Lake Missouila Flood*, *J. Creation* **14**(2):14–17, 2000; creation.com/only-one-lake-missoula-flood.
9. Gupta, S. and Collier, J., *Megaflood Britain*, Department of Earth Science and Engineering, Imperial College, London.
10. Silvestru, E., Wild, wild floods! *J. Creation* **22**(1): 12–14, 2008. See also précis of his article at creation.com/north-sea-megaflood.
11. Bonneville flood, wikipedia.org/w/index.php?title=Bonneville_flood&oldid=586345600, 16 December 2013; accessed 1 September 2014.
12. O'Connor, J.E., Hydrology, Hydraulics, and Geomorphology of the Bonneville Flood, *Geological Society of America, Special Papers* **274**:1–84, 1993.
13. Humphreys, D.R., *Starlight and Time*, Master Books, Green Forest, AR, 1994.
14. Hartnett, J.G., Tension, not extension in creation cosmology, creation.com/tension-not-extension-in-creation-cosmology, 12 August 2014.
15. Humphreys, D.R., New view of gravity explains cosmic microwave background radiation, *J. Creation* **28**(3):106–114, 2014.
16. Baumgardner, J.R., ^{14}C evidence for a recent global Flood and a young earth; in: Vardiman, L., Snelling, A.A. and Chaffin E.F. (Eds.), *Radioisotopes and the Age of the Earth, Volume II,* Institute for Creation Research, El Cajon, CA, and Creation Research Society, Chino Valley, AZ, pp. 587–630, 2005.
17. Silvestru, E., The evolutionary paradox of the Roraima pollen of South America is still not solved, *J. Creation* **26**(3):54–59, 2012.
18. Woodmorappe J., *The Mythology of Modern Dating Methods*, The Institute for Creation Research, El Cajon, CA, 1999.
19. Hartnett, J., *Starlight, Time, and the New Physics*, 2nd edn., Creation Book Publishers, Atlanta, GA, pp. 25–37, 2010.
20. Roth, A.A., 'Flat gaps' in sedimentary rock layers challenge long geologic ages, *J. Creation* **23**(2): 76–81, 2009.
21. Lewontin, R.C., Billions and Billions of Demons; in: *The New York Review of Books*, p. 31, 9 January 1997.

The Appalachian Mountains are young

Michael J. Oard

In the United States, most students learned in their grade school geography class that the Appalachian Mountains have the appearance of old age since they are rather rounded or 'subdued'. They may have also learned the Appalachians are predominantly composed of Paleozoic sedimentary rock. However, there are places in the Appalachian Mountains that are rugged, indicative of recent uplift:

> "Conventional wisdom holds that the southern Appalachian Mountains have not experienced a significant phase of tectonic forcing for >200 myr; yet, they share many characteristics with tectonically active settings, including locally high topographic relief, steep slopes, incised river gorges, and frequent mass-wasting."[1]

There are places with steep vertical cliffs 600 m high in western North Carolina (figure 1). Vertical faces erode much faster than horizontal surfaces, largely from rockfall. 'Old' terrains should not have cliffs. The vertically walled canyons should have become V-shaped valleys long ago if uniformitarian dating were correct.[2]

'Solving' the Appalachian problem

The Appalachian problem was 'solved' by secular scientists postulating more than one uplift, the last called a 'rejuvenation'.[3] The authors use the Cullasaja River basin in Tennessee and North Carolina to show that the most recent uplift was in the late Miocene, about 8.5 million years ago. They noticed that

the Cullasaja River and its tributaries have numerous knickpoints and sharp convexities in an otherwise concave-up longitudinal river and stream profile. Knickpoints are characterized by waterfalls, rapids, or steep gradients in the river or stream. The authors analyze and eliminate all other mechanisms for knickpoint generation except uplift. They determine the time of uplift by using the regression of tributary knickpoints that begin at the junction with the main river and migrate headward. This calculation is based on uniformitarian dates and slow erosion over millions of years, giving it a late Miocene date.

Flood geology reinterpretation

One aspect of Flood geology is to reinterpret observations made by uniformitarians.[4] The secular Appalachian data looks 'solid', so how would we go about reinterpreting the data? The beginning point would be to place the erosion of the Appalachian Mountains within the Biblical Geological Model.[5] Within this framework the erosion of the Appalachian Mountains and the development of the Cullasaja River Basin would have occurred during the Recessive Stage of the Flood. The erosion in the central Appalachians is around 6,000 m, based on the rank (i.e. the stage attained in the progression from vegetation to anthracite) of coal and the amount of sedimentary rocks and sediments on the continental margin.[6,7] This estimate is close to the uniformitarian estimate.[8] Erosion this deep and extensive would be characterized by the Abative or Sheet Flow Phase during the early part of the Recessional Stage of the Noahic Flood.[6,9] Such activity would have occurred during differential uplift of the Appalachians and the sinking of the continental margin by about 14 km![10]

The Cullasaja River valley, as well as other river valleys, display more linear forms of erosion that would be placed in the Dispersive or Channelized Flow Phase, during the latter half of the Recessional Stage. The Cullasaja River Valley was carved after the general erosion of the Appalachians. It would be at this time that the knickpoints retreated rapidly headward, close to where they exist today, indicating that the Appalachian Mountains are young. It was also at this time that hundreds of water and wind gaps were formed by channelized erosion across ridges.[11,12] After the Flood the knickpoints would have retreated only slightly.

Figure 1. Blue Ridge Escarpment, a 600-m high cliff at Caesars Head State Park, North Carolina (view southeast), is an example of a steep escarpment in the Appalachian Mountains.

References

1. Gallen, S.F., Wegmann, K.W. and Bohnenstiehl, D.R., Miocene rejuvenation of topographic relief in the southern Appalachians, *GSA Today* **23**(2):4, 2013.
2. Twidale, C.R., *Geomorphology*, Thomas Nelson, Sydney, Australia, p. 165, 1968.
3. Gallen *et al.*, ref. 1, pp. 4–10.
4. A problem with geological observations is that they sometimes contain a select sample and cause a bias to creep into the interpretation. This is an excellent reason for creationists to do their own field work in geology and paleontology.
5. Walker, T., A biblical geologic model; in: Walsh, R.E. (Ed.), *Proceedings of the Third International Conference on Creationism*, technical symposium sessions, Creation Science Fellowship, Pittsburgh, PA, pp. 581–592, 1994; biblicalgeology.net/Model/A-biblical-geological-model-ICC-paper.html.
6. Oard, M.J., Origin of Appalachian geomorphology Part I: erosion by retreating Floodwater and the formation of the continental margin, *Creation Research Society Quarterly* **48**(1):33–48, 2011.
7. Oard, M.J., *Earth's Surface Shaped by Genesis Flood Runoff*, 2013, michael.oards.net/GenesisFloodRunoff.htm (especially chapter 8 and appendix 4).
8. Pazzaglia, F.J. and Gardner, T.W., Late Cenozoic landscape evolution of the US Atlantic passive margin: insights into a North American Great Escarpment; in: Summerfield, M.A. (Ed.), *Geomorphology and Global Tectonics*, John Wiley & Sons, New York, p. 287, 2000.
9. Oard, M.J., Origin of Appalachian geomorphology Part II: surficial erosion surfaces, *Creation Research Society Quarterly* **48**(2): 105–122, 2011.
10. Poag, C.W., U.S. middle Atlantic continental rise: provenance, dispersal, and deposition of Jurassic to Quaternary sediments; in: Poag, C.W. and de Graciansky, P.C. (Eds.), *Geological Evolution of Atlantic Continental Rises*, Van Nostrand Reinhold, New York, pp. 100–156, 1992.
11. Oard, M.J., Origin of Appalachian geomorphology Part III: channelized erosion late in the Flood, *Creation Research Society Quarterly* **48**(4):329–351, 2012.
12. Oard, ref. 7, especially chap. 77.

Tall molars did not evolve from eating grass

Michael J. Oard

It is a classic tale of evolutionary biology that tall or high-crowned molars (hypsodonty) in mammals only evolved when grasslands evolved.[1] This supposedly took place during the Cenozoic[2] when the cooling climate caused forests to change into extensive grasslands. It was thought the high-crowned molars developed as a result of wear from eating grass containing phtoliths (silica-rich granules). Worn-out teeth supposedly caused the mammals to develop taller, longer-lasting teeth (figure 1). New evolutionary research calls into question this classic tale.

Hypsodonty out of phase with grasslands

Researchers using Cenozoic dating methods for various groups of ungulates (hoofed animals), as well as rodents and rabbits, discovered that the origin of hypsodonty was *out of phase* with the supposed spread of grasslands in the United States' Midwest. Some animals developed high crowns before and some after the supposed 'evolution' of the grassland. Moreover, many mammal families did not evolve tall teeth at all. Therefore, the researchers have mostly abandoned the classic tale but have adopted a new hypothesis. They now claim high-crowned teeth were not due to the evolution of grasslands but from the effects of grit and soil:

> "These results indicate that hypsodonty was not a simple adaptation for eating grass, and may have originated in some clades [groups of animals] to counteract the ingestion of grit and soil."[3]

This hypothesis seems even less plausible because previously the abrasive agent was in the food, while in the new idea the abrasive agent is the soil, which would rarely be consumed.

Creationist implications

The first lesson learned from this story is to be aware of the speculation advanced for the purpose of maintaining the evolutionary *status quo*. The hypothesis of evolution often requires 'just so stories' to explain difficulties when interpreting fossils, radiometric dating, or paleoenvironments. In the biological sciences in particular, recourse is often had to the assumption that non-existent genetic information will somehow be created in response to a perceived environmental need.

Secondly, we must always be alert to the fact that circular reasoning is common within evolutionary biology and paleontology.[4–7] Just as with uniformitarian paleoenvironmental interpretations,[8] we must be aware of circular reasoning and the reinforcement syndrome, the tendency to keep evolutionary concepts going with 'further research'. Circular reasoning is shown in the issue of hypsodonty in that evolutionists have used it as *diagnostic* of a grassland, when there is no paleobotanic evidence.[1] They have also used hypsodonty as a measure of aridity:

> "Fossil ungulate assemblages have recently been employed as palaeoprecipitation indicators, with community hypsodonty levels being a key character for measuring aridity … ."[9]

It would not be surprising if the 'degree of hypsodonty' has been used to 'date' a particular mammal group during the Cenozoic, but the main article gave no indication of this. The assumed paleotemperature, based on the particular fossil assemblage, has been used as input to place the fossils within the Cenozoic era, which presumably was generally cooling throughout.[8,10]

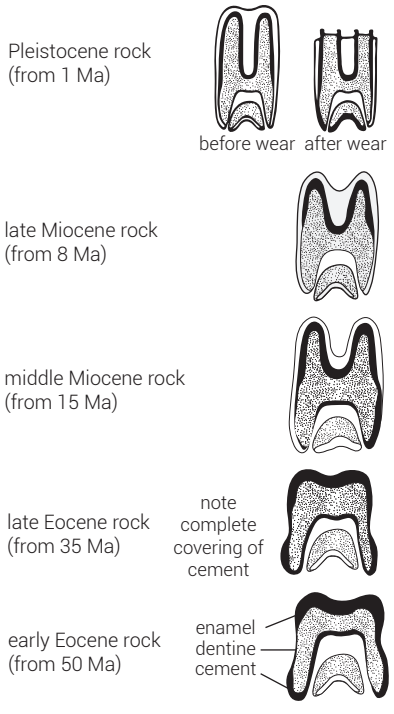


Figure 1. Evolution of taller teeth during the supposed evolution of the horse in the Cenozoic (from wikipedia). Evolutionists no longer consider this a 'straight-line' pattern because the fossil record has many exceptions.

References

1. Jardin, P.E., Janis, C.M., Sahney, S. and Benton, M.J., Grit not grass: concordant patterns of early origin of hypsodonty in Great Plains ungulates and Glires, *Palaeogeography, Palaeoclimatology, Palaeoecology* **365–366**:1–10, 2012.
2. The geological timescale and subdivisions are used for discussion purposes only.
3. Jardin *et al.*, ref. 1, p. 1.
4. Oard, M.J., Paleocene dinosaurs and the reinforcement syndrome, *J. Creation* **17**(3):5–8, 2003.
5. Oard, M.J., End-Mesozoic extinction of dinosaurs partly based on circular reasoning, *J. Creation* **15**(2):6–7, 2010.
6. Oard, M.J., *Dinosaur Challenges and Mysteries: How the Genesis Flood Makes Sense of Dinosaur Evidence—Including Tracks, Nests, Eggs, and Scavenged Bonebeds*. Creation Book Publishers, Powder Springs, GA, pp. 156–162, 2011.
7. Oard, M.J., The reinforcement syndrome ubiquitous in the earth sciences, *J. Creation* **27**(3):13–16, 2013.
8. Oard, M.J., Beware of paleoenvironmental deductions, *J. Creation* **13**(2):13, 1999.
9. Jardin *et al.*, ref. 1, p. 8.
10. Oard, M.J., Is the K/T the post-Flood boundary?—part 2: paleoclimates and fossils, *J. Creation* **24**(3): 87–93, 2010.

Dino-bird theory—a flight of fancy

Jerry Bergman and Philip Snow

A review of the extensive literature covering the more popular theories of the evolution of birds was completed. Of the numerous theories proposed, all of them were found to be problematic, and for this reason most are now rejected by evolutionists. The most popular current theory, the evolution of birds from dinosaurs, was briefly reviewed, and also found to suffer from major problems, some of which were discussed. The major problem is the differences between birds and both reptiles and mammals, and the fossil record has not been of much help in solving this evolutionary problem. Nor have genetic or biochemical comparisons.

Birds (class Aves) are winged, feathered, bipedal, endothermic (warm-blooded), hard-shelled egg-laying vertebrates that have horny bills instead of teeth.[1] They are programmed to achieve complex activities, such as building intricate nests and singing elaborate songs. Of all higher lifeforms except humans and dogs, birds are arguably the most beautiful, melodious, admired, studied—and defended.[2]

All living bird species possess wings except the now extinct flightless Moa of New Zealand. Except ratites, penguins, and several diverse endemic island species, all birds are excellent flyers. Their entire anatomy and physiology is designed around their flight abilities. Bird design even includes an eloquently designed locking mechanism in their toes to insure that they do not fall off their perches while sleeping. Their navigational skills are unsurpassed in the animal world:

> "The amazing navigational skills shown by migratory birds are believed to result from tiny magnetic crystals set in the upper beak, creating a compass, combined with an astounding ability to memorize features of land and sky, such as star patterns."[3]

Their flying feats are astounding—falcons can fly as fast as 290 km/h (180 mph). Many bird species undertake annual long-distance migrations, and many more take shorter irregular journeys. Furthermore, their variety is enormous, with twice as many known kinds of birds as mammals.

Birds are among the most successful of all land animals, and the most varied of all known chordates.[4] The estimated 10,000 living bird species inhabit every known ecosystem from Arctic to Antarctic, including desert, temperate, and tropical lands. Furthermore, this enormous variety extends all the way back to the origin of birds.[5]

Evidence for bird evolution

The most common theory of bird evolution is that birds resulted from "the culmination of a long process of development. For millions of years this process has been going on, building up in the race for perfect mastery of the air."[6]

Thomas Henry Huxley first proposed in the 1800s that birds evolved from some dinosaur-like creature, because he noted that the bone structure of a small rooster-sized dinosaur called compsogna and the *Archaeopteryx* (figure 1) were very bird-like. He also noted that the skeleton of certain modern birds, such as ostriches, looked remarkably similar to many dinosaur skeletons (figure 2).[7]

In spite of skeletal similarities, this theory, and the entire field of the "origin of birds and avian flight … has been among the most contentious issues in paleobiology".[8] Furthermore, "the evolutionary history of birds has long been an enigma. Ever since a single fossil feather was dug up 150 years ago, the origin of birds has been one of biology's most contentious issues."[4]

The origin of birds is one of the most problematic fields in evolution for reasons that include a complete lack of uncontested fossil evidence except that of the very controversial *Archaeopteryx* and the protoavis (meaning 'first bird') discovered by Sankar Chatterjee in 1984.[9] Protoavis, which Chatterjee described as a modern crow-like 35-cm-tall bird, is regarded by its supporters as "much more closely related to modern, neornithine birds than is *Archaeopteryx*".[10] Chatterjee interpreted his fragmentary remains of a Late Triassic specimen to be from a single animal that lived in what is now Texas, that he estimates c 210 Ma ago. The fossils were believed to be a primitive bird, which, if the identification is valid, would push back avian origins, according to evolutionists, some 60–75 Ma.

Though it existed far earlier than *Archaeopteryx*, its skeletal structure appears more bird-like with teeth on the tip of its jaws and eyes located at the front of its skull, indicating a nocturnal or crepuscular lifestyle. A recent re-evaluation has convinced most paleontologists that Protoavis is not a bird, and that all the remains did not come from a single species. Its fossils were found in a jumbled cache of disarticulated bones that indicate mass mortality following

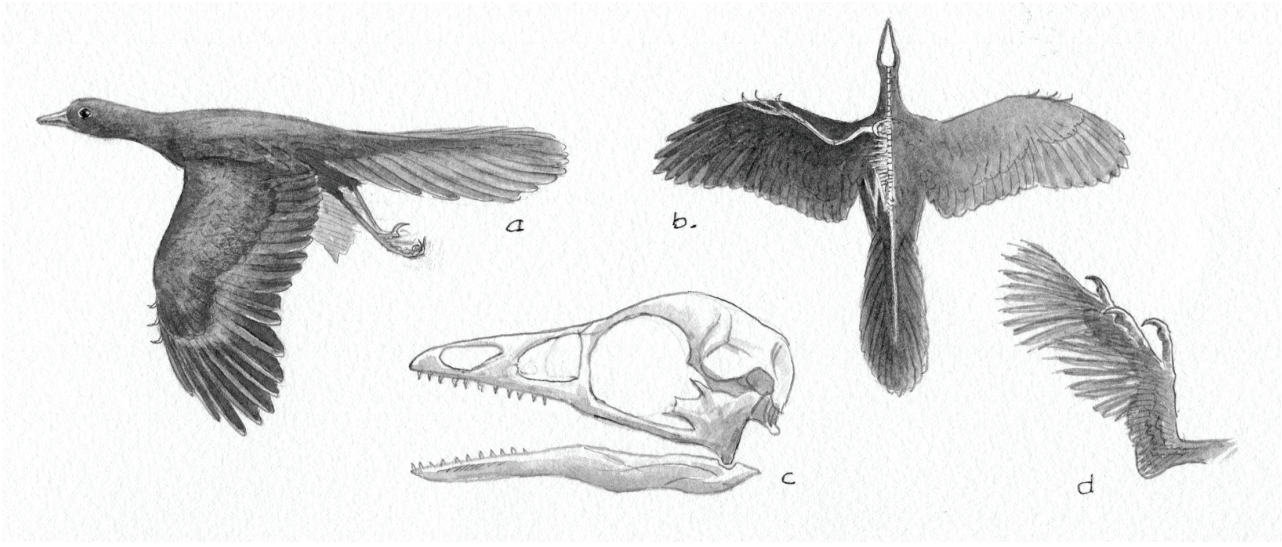


Figure 1. *Archaeopteryx lithographica* [AL] reconstructions by Philip Snow: (a) AL; (b) AL after Reitschel (from Shipman, P., *Taking Wing*, 1998); (c) AL skull reconstruction after Martin, L. and Buhler, P.; (d) Wing claws of modern Hoatzin juvenile.

a flash flood. As a result *Archaeopteryx* "stands alone in the fossil record of birds of the end of the Jurassic period".[11] *Archaeopteryx* origin theory is also problematic:

> "*Archaeopteryx* has always been considered to be the most primitive as well as the most ancient bird. Yet its strange mix of traits—the teeth, legs, claws and tail of a dinosaur but the wings and feathers of a bird—continues to raise doubts about its true affinities. Recent discoveries have only added to the enigma."[4]

After the "discovery of *Archaeopteryx*, no other reptile-bird intermediates were found for many years, leaving a gaping hole between modern birds and their ancestors".[12]Although Coyne claims that a "spate of astonishing discoveries from China began to fill in the gap", none of these discoveries actually fill in this enormous gap. Almost all examples that Coyne lists of so-called proto-feathered dinosaurs, or putative feathered dinosaurs, have been refuted or questioned because the research

> "… findings show no evidence for the existence of protofeathers and consequently no evidence in support of the follicular theory of the morphogenesis of the feather. Rather, based on histological studies of the integument of modern reptiles, which show complex patterns of the collagen fibers of the dermis, we conclude that 'protofeathers' are probably the remains of collagenous fiber 'meshworks' that reinforced the dinosaur integument. These 'meshworks' of the skin frequently formed aberrant patterns resembling feathers as a consequence of decomposition. Our findings also draw support from new paleontological evidence."[8]

The fossil record

The major problem for evolutionists is, "of all the classes of vertebrates, the birds are least known from their fossil record".[13] Of the many bird and other fossils discovered so far, none help to bridge the enormous gap between birds and any theorized ancestors. Many bird fossils are extinct birds, some very different from modern birds, but all appear in the fossil record as fully formed birds. A large chronological and phylogenetic gap even exists between the so-called first bird, *Archaeopteryx*, and the life-forms postulated to be the key to avian origins that cannot be explained away by the putative feathered dinosaurs.[10]

Another problem is that not much weight "can be placed in single fossil elements or bone fragments that have so frequently been described from both the Cretaceous and early Tertiary: regretfully, many must simply be ignored".[14] Unfortunately, many ancient birds consist only of fragmentary evidence.

The lack of fossil evidence for bird evolution is often explained by postulating an extraordinarily explosive evolution of birds, one that produced all living orders within a "short time frame like the Cambrian explosion".[15] So, the "tremendous diversity of early avian" animals documents an avian evolutionary explosion similar to the Cambrian explosion. Therefore, the origin of birds has stirred "intense, nearly century-long, controversies".[16]

One very early theory postulated birds that evolved from dinosaurs, but fell out of favour with Professor Heilmann's 'hugely influential book' in 1926, which argued birds "evolved from a primitive archosaur reptilian group which also gave rise to dinosaurs, pterosaurs and crocodiles".[17]

A classic 1935 book on birds concluded that it is "among the reptiles that we must look for the origin of birds in the fossil record."[6] Therefore it is among the reptiles that, for the past century and a half, evolutionists have looked for evidence of bird evolution without finding any valid evidence for bird origins, although some debated evidence has been found, such as the dinosaur proto-feathers noted above.

The Aymar text includes *Archaeopteryx*, *Archaeornis*, the dodo, and others, but admits no good evidence exists for bird evolution. No significant progress has been made on bird evolution since 1935, although Whetstone and Martin claim that a recent upheaval in bird evolution theory has occurred:

> "During the period 1926–73 most ornithologists and vertebrate palaeontologists supported Heilmann's theory of avian origins. Heilmann argued that all dinosaurs and pterosaurs were too specialized to have been ancestral to birds. Instead he chose to derive birds directly from a primitive group of Triassic archosaurs, the Pseudosuchia. Heilmann's theory has recently been challenged by Walker, who has suggested that birds evolved from an early crocodilian, and by Ostrom, who argued that birds descended from theropod dinosaurs."[18]

Currently, the most popular theory is that birds evolved from a theropod dinosaur during the Jurassic period, estimated by evolutionists to be about 150 to 200 Ma ago. Many paleontologists regard birds as the only dinosaur clade to have survived the Cretaceous–Tertiary extinction event, dated by evolutionists approximately 65.5 Ma ago. Colbert writes:

> "It has long been evident that birds are descended from archosaurian reptiles, and for many years it was thought that they had a theocodont ancestry … . Thus, in one sense, dinosaurs did not become completely extinct because one line of theropods evolved into all the birds alive today."[19]

Colbert adds that although the "majority of workers today hold the view that birds are descendants of theropods" other paleontologists have concluded that

> "… the similarities between birds, especially *Archaeopteryx,* and small theropods are the result of convergent evolution in the two lineages from a common ancestor that was an advanced ornithosuchian thecodont. In this minority view, theropods and birds are not ancestor and descendant, respectively, but rather are sister groups that evolved from the same ancestor group."[19]

The main evidence for the conventional view of dinosaur-bird evolution are the commonalities between birds and certain dinosaurs, such as similarities in bone structures existing at both macroscopic and microscopic levels. Major problems include the many anatomical and size differences, and the fact that both dinosaur and bird fossils are commonly found together in the fossil record, but no set of existing fossils show a set of intermediate transitional forms.

Figure 2. Imagined comparisons of flightless bird with dinosaur, reptile, and 'ancient birds': (a) Ostrich; (b) Hadrosaur; (c) coelurosaurus (gliding reptile); (d) Protoavis; (e) *Archaeopteryx lithographica*.

From which dinosaur did birds evolve?

The controversy about bird origins also questions whether they evolved from dinosaurs or from more primitive archosaurs. Researchers disagree about whether ornithischian or theropod dinosaurs were more likely to be the ancestors of birds because little or no evidence of fossil transitions exists to support either theory. Although ornithischian (bird-hipped) dinosaurs share the basic hip structure of modern birds, the saurischian (lizard-hipped) dinosaurs have more similarities to birds, thus are more widely accepted as the bird ancestor.

Therefore some evolutionists argue that birds must have evolved their ornithischian hip structure independently of dinosaurs, yet postulate them to have evolved at least three separate times, finally among a group of theropods known as the Therizinosauridae. Other ornithologists argue, based on fossil and other evidence, that birds are not dinosaurs, but evolved from some early archosaur such as Longisquama.

The 1913 discovery of the small carnivorous animal *Euparkeria*, the best-known member of the pseudosuchians, seemed to solve the mystery of the origin of birds. It had a collarbone, and could run either bipedally or on all fours, and had lived earlier than any known fossil bird.[20] The *Euparkeria* origins theory became so well accepted that "for over fifty years the problem of the origin of birds was thought to be solved".[20]

The theory hypothesized that pseudosuchians were the ancestors of not only birds, but also pterosaurs, dinosaurs, and, later, archosaurs.[21] That theory was not seriously questioned until the 1970s; since when a dozen or so theories of bird origins have been advanced, all of which have good reasons why they cannot be scientifically valid. Feduccia *et al.* write that before

> "… the 1970s birds and dinosaurs were thought to have shared a common ancestry through Triassic basal archosaurs, often collectively termed thecondonts, characterized by the Triassic *Euparkeria*. But with John Ostrom's discovery of the bird-like Early Cretaceous *Deinonychus*, the dinosaurian origin of birds gained ascendancy as the reigning dogma, based on overall similarity of this newly discovered dromaeosaur to birds and *Archaeopteryx*."[8]

Challenging the *Euparkeria* hypothesis was an idea proposed in 1972 that birds evolved from crocodylomorphs (animals similar to crocodiles). Based on comparisons such as the ear region of living birds and crocodiles, and also that of fossil reptiles and dinosaurs, Whetstone and Martin rejected the dinosaurian ancestry for birds, concluding that these "advanced features in the ear region support a common ancestry for crocodiles and birds, independent of both saurischian and ornithischian dinosaurs".[21]

The crocodylomorph that birds were considered to be most closely related to was the sphenosuchus. Although the external morphology of crocodylomorphs and birds were very different, they possessed a number of critical skull similarities, including teeth shapes, ear region details, jawbone attachment system and skull cavity design.[22] The theory soon lost favour, mostly because too many major differences in external morphology exist, and a new, more plausible discovery, deinonychus, came along.

Deinonychus as the link to birds

A fourth theory is that birds evolved from Coelurosaurs, then into Ornithurines (which include *Ichthyornis*, *Hesperornis*, *Hongshanornis*, and *Gansus*) and, ultimately, into modern birds, a theory that Cusack admitted had "great gaps".[23] Other paleontologists concluded that birds evolved from pterosaurs based on the many structural similarities they share with birds.[24]

Others concluded that birds could not have evolved from any type of dinosaur because dinosaurs were "too specialized to have been the ancestors of birds".[24] Other problems with the dinosaur-bird theory include the fact that many major structural differences exist between them—birds have wishbones and most all dinosaurs and pterosaurs do not even possess collar-bones. This exemplifies the clear limitations of using morphology as a basis for postulating evolutionary ancestry.

Another theory postulates that birds evolved from a small coelurosaurian dinosaur called compsognathus,[25] a small (rooster-sized) theropod saurischian dinosaur that Huxley first discussed. Although bipedal with bird-like legs, it definitely was lizard-like. Compsognathus was largely selected as an ancestor of birds because it is physically the closest known extinct animal to birds. Coelurosaurs and Ornithurines both were judged to be "more advanced in design than their contemporary 'cousins'" and also had some 'primitive' traits like *Archaeopteryx's*, such as wing claws. Actually, the fossil record shows that most birds have a combination of so-called primitive and modern traits. As a result, a term now

> "… consistently used by researchers in regard to the pattern of evolution [of birds] is 'mosaicism'. It pretty much discards the long held dream of finding a direct ancestral line, since progress over many tens of millions of years seems to have come in tiny spurts across a huge variety of experiments. It may be that identifying sister groups is as close as can ever be achieved."[26]

As Witmer noted, some theories about bird evolution "came and went quickly" and the next in vogue concerned a small theropod saurischian called Deinonychus.[22] This

animal was "very closely related to Velociraptor".[27] Support for this theory included the fact that Deinonychus, although very different from most modern birds, possessed a number of critical similarities to Archaeopteryx, including number and shape of the snout openings, position of the teeth, number of fingers, comparative sizes and shape of the wrist bones and phalanges, hip bone arrangement, and foot and ankle structure similarities.[28]

Although *Deinonychus* is more similar to birds than to other dinosaurs, it still is very different than birds.[29] Other candidates are even more different. Nonetheless, the *Deinonychus* theropod-like dinosaur ancestor of birds theory is now the most widely accepted view in spite of many problems and disagreements.

One reason for disagreement is because other theropod dinosaurs, such as *Troodon*, are even more similar to birds; although arguments for *Troodon* include that *Deinonychus* has "certain skull traits closer to birds, and lacks the many bird-like features of *Deinonychus*."[30] The major problem with this theory of bird origins is that "nearly all of the birdlike theropod dinosaurs appeared later in time than the first bird, *Archaeopteryx*".[31]

The ancestor of birds should not be younger than its descendants. Evolutionists deal with the problem by assuming *Troodon* and *Deinonychus*, or both, are descendants of the common ancestor of *Deinonychus*, *Troodon*, and birds. However, no fossil evidence exists for this view. A second theory is that both *Troodon* and *Deinonychus* evolved from birds, a subject treated below. A third theory is that both the *Troodon* and *Deinonychus* theories are wrong and all of the bird-like traits in these animals evolved separately and do not provide evidence for evolution.

The argument for the origin of birds by *fiat* creation

The last theory presented here is that birds and theropods were created separately and did not evolve. This explanation best fits the fossil record and all of the other known facts. One is the enormous gap between birds and dinosaurs because

> "… over the decades researchers who doubted the dinosaur-bird link also made good anatomical arguments. They said dinosaurs lack a number of features that are distinctly avian, including wishbones, or fused clavicles; bones riddled with air pockets; flexible wrist joints; and three-toed feet. Moreover, the posited link seemed contrary to what everyone thought they knew: that birds are small, intelligent, speedy, warm blooded sprites, whereas dinosaurs—from the Greek for 'fearfully great lizard'—were coldblooded, dull, plodding, reptile-like creatures."[31]

Since detailed evidence of dinosaur anatomy is lacking, comparisons are in some ways very problematic. Comparing skeletons of extant and extinct animals provides only conflicting theories of bird evolution. Although fused clavicles have been found in some dinosaurs, major differences between birds and dinosaurs remain. Many evolutionists continue to hope to find fossils that provide conclusive evidence for one of the proposed theories, but after almost two centuries of looking, and billions of fossils uncovered, they're still hoping![32] Witmer concludes that many of the clues to bird evolution

> "… point to different and conflicting stories. *Deinonychus* does indeed resemble the Jurassic bird *Archaeopteryx*. But what about *Troodon*? What about *Protoavis*? And what about the 'time problem?' Where are the Jurassic relatives of *Deinonychus* and *Troodon*, if they existed at all? These questions still need to be answered. There are points of agreement, however. The ancestor of birds was probably a small theropod dinosaur, probably resembling *Deinonychus*."[33]

Problems with the dinosaur-bird theory

Although many paleontologists accept dinosaur-bird descent theory, a wide variety of bird forms from the Cretaceous Period have caused major problems in the theory. John Ruben, of Oregon State University, wrote, "When interpreting the Paleobiology of long extinct taxa, new fossils, and reinterpretations of well-known fossils sharply at odds with conventional wisdom never seem to cease popping up."[16] Ruben added that

> "… it would have been quite possible for birds to have evolved and then, at some point, have various species lose their flight capabilities and become ground-dwelling, flightless animals—the raptors. This may be hugely upsetting to a lot of people, but it makes perfect sense."[34]

Another problem is that millions of fossilized bird tracks have been found alongside dinosaur foot tracks in many parts of the world, precluding their evolution from dinosaurs.[35] Evolutionists cite this as compelling evidence that birds and dinosaurs have a common ancestor.

An unusual fossil discovered in 2003 called 'microraptor' also caused major questions about the dinosaur-to-bird evolution theory. Three-dimensional models were used to study its flight potential, concluding this small-feathered species must have been a 'glider' that jumped from trees. A 1915 drawing by naturalist William Beebe shows one theoretical view of early birds bearing a striking similarity to a fossil discovered in 2003 that is raising major doubts about the theory that birds descended from ground-dwelling theropod dinosaurs.[36]

University of Kansas scientists recently examined a fossil bird that had feathers on all four limbs, thus somewhat resembling a biplane.[37] Glide tests have determined that it would have been impractical for it to have flown from

the ground up, but it could have glided down from trees somewhat like modern-day flying squirrels.

Many researchers have long believed that some type of glider, and not a tetrapod dinosaur, was the ancestor of birds. In contrast, if birds descended from theropod dinosaurs, a great lineage of ground-dwelling meat-eaters with strong hind legs and short forelimbs must have existed, a lineage for which no evidence has been located.

The level of speculation involved in bird evolution is indicated by one expert who noted that the dinosaur-bird "model was not consistent with successful flight from the ground up, and that makes it pretty difficult to make a case for a ground-dwelling theropod dinosaur to have developed wings and flown away". The new research

> "… is consistent with a string of recent studies that increasingly challenge the birds-from-dinosaurs theory … . The weight of the evidence is now suggesting that not only birds did not descend from dinosaurs, but that some dinosaur species may have descended from birds. We're finally breaking out of the conventional wisdom of the last 20 years, which insisted that birds evolved from dinosaurs. This issue isn't resolved at all."[33]

But if dinosaurs evolved from birds, where did birds come from? The conclusions of almost 20 years of research at Oregon State comparing birds and dinosaurs is much more consistent with the view that birds had an ancient common ancestor with dinosaurs, but evolved separately along their own path and not from dinosaurs.

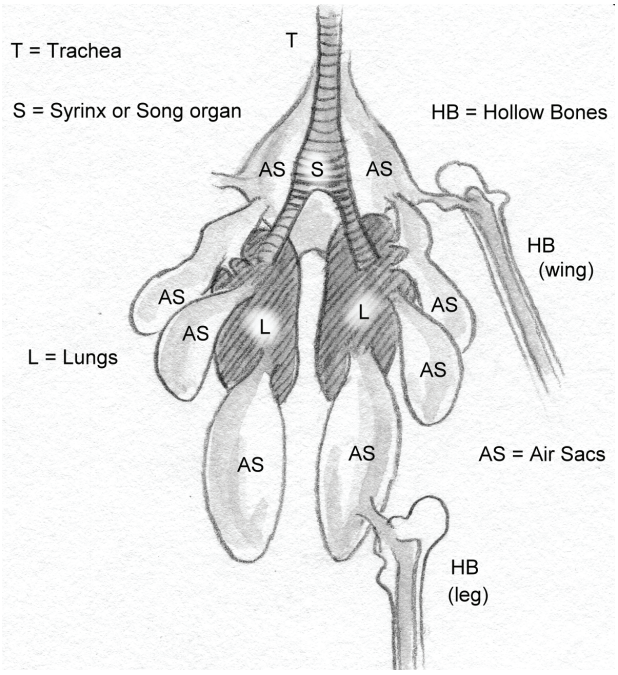


Figure 3. Modern bird's respiratory system, simplified.

This view postulates that, after millions of years of separate evolution, raptors evolved from birds. Support for this is mainly the idea that raptors "look quite a bit like dinosaurs but they have much more in common with birds than they do with other theropod dinosaurs such as Tyrannosaurus [Rex]".[33]

The researchers concluded that raptors, which are considered dinosaurs, were "actually descended from birds, not the other way around. Small animals such as velociraptor that have generally been thought to be dinosaurs are more likely flightless birds."[34] Other studies have raised similar doubts.[38]

Anatomical differences between birds and non-birds

A major problem in determining what non-bird animal birds evolved from is the chasm that exists between birds and all other animals. One example is that birds are highly adapted for flight, including birds' unique digestive and respiratory systems, their high metabolic rate, and lightweight, but very strong, skeleton. In some ways birds are more similar to mammals than reptiles. For example, in contrast to reptiles, birds have a four-chambered heart like mammals.

Among the other radical changes required to convert a reptile into a bird is reptiles' bellow lungs, similar to mammals', which must be converted into a bird tube lung. Mammal lungs draw air into tiny sacs called alveoli where red blood cells extract oxygen and allow carbon dioxide to be exhaled out of the same pathway that air travelled into the lungs.

In contrast, birds have a unique and elaborately complicated system of air sacs involving the head and neck sinuses and air sacs in the thorax designed to insure that air flows in one direction through special tubes in the lung system called parabronchi (figure 3). Blood moves through the lung's blood vessels in the opposite direction, allowing very efficient oxygen uptake. This superior engineering design allows birds to conserve the energy normally used for breathing.

How the 'bellows' lung system of mammals and reptiles could have gradually evolved into avian lungs has baffled evolutionists for generations because all hypothetical intermediate stages were non-functional, and therefore the animal could not breathe during the transition. Natural selection would preserve the existing reptile arrangement and eliminate any misfit intermediates required to evolve the modern respiratory bird system. The fact that the design of the avian respiratory system is extremely similar in all birds is evidence that bird-reptile transitions are not even remotely feasible.[39]

Assuming that a theoretical series of functional intermediate stages could be constructed, natural selection alone could not drive the bird gas exchange evolution because bats manage very well with bellows-style mammal lungs. This indicates that flying birds could also function fairly well with bellows-style lungs. There would thus have been no major selective advantage in replacing the reptilian lung design with a new, radically different, respiratory system.

Although the avian lung's super-efficient design is especially advantageous at very high altitudes where low oxygen levels exist—some species can hunt at altitudes of over 2 miles (3 km) high—the fact that bats do very well at low altitudes indicates that only a minor, if any, selective advantage exists for the bird system, at least at lower altitudes.

Another major difference between reptiles and birds is that reptiles are cold-blooded and birds are warm-blooded. Aymar speculates that this evolution occurred as follows:

> "From the cold-blooded, sluggish reptile this increased activity of climbing, gliding and finally flapping, changed it into a warm-blooded animal. The feathers acted as insulation to protect it from the cold."[40]

Other differences include that bird and dinosaur bones are very different. For example, theropods lacked collarbones (clavicles), which fuse together to become the wishbone (furcula) in birds. Heilmann (1926) argued that if this feature were lost it would have to have re-evolved at a later date—a very unlikely scenario— thus theropods could not be the ancestor of birds.[41] Yet another contrast between birds and dinosaurs is the enormous size difference. The average modern bird is about the size of the average dinosaur heart. Learning to fly is yet another major problem for the bird-to-dinosaur evolution theory.[42]

The biochemical evidence

Evidence derived from DNA hybridization and other biochemical studies disagrees with the current fossils-based phylogeny of birds. For example, the results of biochemical research for totipalmate birds (pelicans, boobies, gannets, cormorants, anhingas, frigatebirds, and tropicbirds), has produced a conclusion rejected or greeted with surprise by ornithologists, namely that DNA comparisons indicate that *Pelecanus* is the sister group of the Shoebill (*Balaeniceps rex*) and that the frigatebirds are part of the *Procellarioidea*, which also includes penguins, albatrosses, petrels, and loons. The evolutionists speculate that tropicbirds appear to be descendants of an ancient evolutionary divergence, which makes them a sister group of a large group of aquatic birds, including the other totipalmate taxa.[43] As more biochemical and genetic research on birds is completed, no doubt the conflicts with the fossil record will continue to create major problems for evolutionists.

Conclusions

An enormous unbridgeable gap, both fossil and morphological, exists between birds and all other animals. The earliest-known bird, *Archaeopteryx*, has been dated back to the Late Jurassic, around 150–145 Ma ago, by evolutionists. Fossil and other evidence is clear: "evolutionary change in avian morphology primarily occurs in terms of minor size adjustments, while changes in shape are very rare".[44]

The evolution of birds has stymied Darwinists since 1859 and still is a major problem. It is clear that "morphological change in birds in general consists of changes in growth such that species become larger or smaller than their ancestors but reclaim their ancestral shape".[45] It is also clear that "many points [of evolution] are still under fierce contention and a lack of fossil material leaves some enormous blank spots".[46] Feduccia *et al.* note, although much heated debate exists, their conclusion "that birds are derived from within the archosaurian assemblage: whether birds are derived from 'dinosaurs' depends largely on how one defines the Dinosauromorpha".[8] As Ruben wrote:

> "When interpreting the paleobiology of long extinct taxa, new fossils, and reinterpretations of well-known fossils, sharply at odds with conventional wisdom never seem to cease popping up. Given the vagaries of the fossil record, current notions of near resolution of many of the most basic questions about long-extinct forms should probably be regarded with caution. Even major aspects of the paleobiology of intensely studied, recently extinct taxa … remain unresolved … . Little wonder then that so fascinating a subject as the origins of birds and bird flight, both of which almost surely occurred more than 150 million years ago, have stirred such publicly visible and intense, nearly century-long, controversies."[16]

The claim by some evolutionists, such as Chiappe, that "the century-old debate on bird ancestry has largely been resolved" is false—he argues for the maniraptoran theropod theory against all of the other theories noted in this review.[47] More accurate is the observation by evolutionist Professor Lawrence Witmer that "we will probably never be lucky enough to find the fossils of the true ancestor of birds".[48] The extant fossil, DNA, and other evidence reveal that the first bird was a bird, and no evidence exists to support the idea that birds evolved from reptiles or any other non-bird animal. The attempts to document the evolution of birds is a long history of discontinuities and reversals and scientists are no closer to the answer today then we were at the time of Darwin.[49]

Acknowledgments

The authors wish to thank Wayne Frair, Clifford Lillo, Theodore Siek, MaryAnn Stuart, Bryce Gaudian, and several anonymous reviewers for their feedback and help with the revisions.

References

1. Witmer, L., *The Search for the Origin of Birds*, Franklin Watts, New York, p. 9, 1995.
2. Peterson, R.T., *The Birds*, Time-Life, New York, p. 9, 1963.
3. Cusack, D., *On the Origin of Birds: A Journey Through Time*, BookSurge Publishing, North Charleston, SC, p. 64, 2008.
4. O'Donoghue, J., Bird evolution: 150 years of flying feathers, *New Scientist* **208**(2790):36–40, 2010; p. 36.
5. Chiappe, L., The First 85 Million Years of Avian Evolution, *Nature* **378**: 349–355, 1995, p. 248.
6. Aymar, G., *Bird Flight; Evolution, Biology, Migration, Aerodynamics*, Dodd, Mead, New York, p. 1, 1935.
7. Stone, R., Dinosaur's living descendants, *Smithsonian* **41**(8):55–62, 2010.
8. Feduccia, A., Lingham-Soliar, T. and Hinchliffe, J.R., Do feathered dinosaurs exist? testing the hypothesis on neontological and paleontological evidence, *J. Morphology* **266**:125–166, 2005; p. 125.
9. Chatterjee, S., *The Rise of Birds*, The Johns Hopkins University Press, Baltimore, MD, 1997.
10. Chiappe, ref. 5, p. 349.
11. Chiappe, ref. 5, p. 253.
12. Coyne, J.A., *Why Evolution is True*, Viking/Penguin Group, New York, p. 40, 2009.
13. Colbert, E.H., Morales, M. and Minkoff, E.C., *Colbert's Evolution of the Vertebrates: A History of the Backboned Animals Through Time*, 5th edn, John Wiley and Sons, New York, p. 6, 236.
14. Feduccia *et al.*, ref. 8, p. 165.
15. Feduccia *et al.*, ref. 8, p. 166.
16. Ruben, J., Paleobiology and the Origins of Avian Flight, *Proceedings of the National Academy of Sciences* **107**(7):2733–2734, 16 February 2010, p. 2733.
17. O'Donoghue, ref. 4, p. 38.
18. Whetstone, K.N. and Martin L.D., New Look at the Origin of Birds and Crocodiles, *Nature* **279**:234–236, 1979; p. 234.
19. Colbert *et al.*, ref. 13, p. 230.
20. Witmer, ref. 1, p. 32.
21. Whetstone and Martin, ref. 18, p. 236.
22. Witmer, ref. 1, p. 33.
23. Cusack, ref. 3, pp. 24–44.
24. Witmer, ref. 1, p. 30.
25. Ostrom, J., The ancestry of birds, *Nature* **242**:136, 1973.
26. Cusack, ref. 3, p. 32.
27. Witmer, ref. 1, p. 36.
28. Witmer, ref. 1, p. 38.
29. Witmer, ref. 1, p. 39.
30. Witmer, ref. 1, p. 42.
31. Stone, ref. 7, p. 56.
32. Witmer, ref. 1, p. 44.
33 Witmer, ref. 1, p. 46.
34. Oregon State University Press Release, *Bird-from-dinosaur theory of evolution*, p. 1, 10 February, 2010.
35. Snow, P., *The Design and Origin of Birds*, Day One Publications, Leominster, Herefordshire, UK, p. 155, 2006.
36. Stevens, R.W., Can evolution make new biological software? *Creation Research Society Quarterly* **46**(1):17–24, 2009.
37. Alexandera, D., Gongb, E., Martina, L.D., Burnhamc, D.A. and Falkc, A.R., Model tests of Gliding with Different Hindwing Configurations in the four-winged Dromaeosaurid *Microraptor gui*, *Proceedings of the National Academy of Sciences* **107**(7):2972–2976, 16 February 2010.
38. University of Montana, How a New Theory of Bird Evolution Came About, *ScienceDaily,* 3 March 2009.
39. Snow, ref. 35, p. 159.
40. Aymar, ref. 6, p. 2.
41. Heilmann, G., *The Origin Of Birds*, Witherby, London, 1926.
42. Stevens, R.W., Can Evolution Make New Biological Software? *Creation Research Society Quarterly* **46**(1):17–24, 2009.
43. Sibley, C. and Ahlquist, J., *Phylogeny and Classification of Birds: A Study in Molecular Evolution*, Yale University Press, New Haven, CT, pp. 491–503, 1990.
44. Björklund, M., Processes Generating Macroevolutionary Patterns of Morphological Variation in Birds: A Simulation Study, *J. Evolutionary Biology* **7**:727–742, 1994; p. 739.
45. Björklund, ref. 44, p. 727.
46. Cusack, ref. 3, preface.
47. Chiappe, ref. 5, p. 252.
48. Witmer, ref. 1, p. 11.
49. Woodmorappe, J., Bird evolution: discontinuities and reversals, *J. Creation* **17**(1):88–94, 2003.

*Ornithologist **Philip Snow** is an author and/or illustrator of over 60 books, articles and other publications on birds and wildlife. These include* The Design and Origin of Bird's *(Day One Publishers UK/USA);* Collins Field Notebook of British Birds*;* Light and Flight—Hebridean Wildlife and Landscape Sketchbook*;* Birdwatching on Mull and Iona, *and* Birds and Forestry*. He has worked in many public and private collections, including HRH Prince Charles, USAF Museum, American Falconry Archives, Welsh Assembly, Welsh National Collection, and Gulf Royalty.*

***Jerry Bergman** has nine academic degrees, including two PhDs. His major areas of study for his graduate work were in biology, chemistry, and psychology. He graduated from Wayne State University in Detroit, Medical University of Ohio in Toledo, University of Toledo and Bowling Green State University. A prolific writer with numerous publications, Dr Bergman has taught biology, chemistry and biochemistry at Northwest State in Archbold, Ohio, for over 24 years. He is also an adjunct Associate Professor at The University of Toledo Medical College.*

No solution to evolution's greatest puzzle

Arrival of the Fittest: Solving Evolution's Greatest Puzzle

Andreas Wagner

Penguin Books, New York, 2014

John Woodmorappe

The author is identified as a Professor of the Institute of Evolutionary Biology and Environmental Studies at the University of Zurich, Switzerland. He lectures worldwide and is a fellow of the AAAS (American Association for the Advancement of Science).

This book is a curious mixture of biological facts that have been recently found and those that had been a mainstay of evolutionary thinking for decades. In this review, I present general principles and do not get into technical details of such things as the capabilities of the RNA molecule that the author has investigated. This I leave to specialists. Owing to the fact that author Andreas Wagner gives many analogies to make his points, I also do so in this review.

Evolutionary selectionism is not enough

Survival of the fittest should not be confused with arrival of the fittest. Wagner acknowledges that the standard way of evolutionary thinking is inadequate,

> "Referring to random change, recited like a mantra since Darwin's time, as a source of all innovation is about as helpful as Anaximander's argument that humans originate inside fish. It sweeps our ignorance under the rug by giving it a different name. This doesn't mean that mutations don't matter, or that natural selection isn't absolutely necessary. But given the staggering odds, selection is not enough. We need a principle that accelerates innovation" (p. 33).

However, Andreas Wagner is inconsistent in his thinking. Later in the book, he falls back on the selectionist view of the evolutionary origin of eyes, where natural selection is supposed to effectively do magic on minor, step-by-step improvements in eyesight.

Origin of life

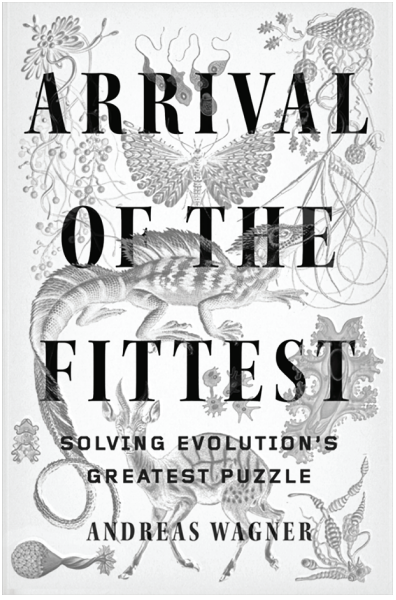
The author dusts off the ideas of Manfried Eigen on hypercycles. He admits, however, that Eigen's paradox still holds.

> "Faithful replication needs long and complex molecules, but long molecules require faithful replication. To this day, nature has not shown us an exit from this labyrinth, but as we shall see in Chapter 6, a principle of innovability found in today's life provides a clue" (p. 46).

(Does it? Innovability exists in today's organisms. It begs the question how this innovability originated!)

Wagner speculates (and I emphasize the term 'speculates') that life originated through a network of autocatalytic chemicals. Chemicals do not make direct copies of themselves. However, a network of chemicals is imagined to cause their indirect 'reproduction'.

Incredibly, Wagner cites certain membranes that divide into smaller droplets when shaken, and states that this shows that membrane droplets can divide like living cells (p. 58)!



This reminds me of the silly argument, made decades ago, by an evolutionist debating Dr Duane T. Gish. The evolutionist actually claimed that protein microspheres were, in a sense, a primitive form of life. The immortal Duane T. Gish replied that the evolutionist's assertion was "absurd in the extreme". Any resemblance to life is completely superficial. (I once told Dr Gish, and he agreed, that it was like saying that a girl's plastic doll is, in a sense, a human infant.) The droplets divide because of simple surface tension, and the contents of the original droplets are divided between the new ones. There is nothing paralleling even the simplest binary fission in bacteria; where DNA is reproduced, the two halves are moved to opposite ends, and a new cell wall grows in the middle to separate the two cell halves into new cells.

In the end, Wagner tacitly admits that evolutionary origin-of-life scenarios are completely speculative, if not wishful thinking (see figure 1). He comments,

> "We do not know—yet—whether the citric acid cycle is the grandfather of all metabolic activity. Nor do we know whether a metabolism of any sort came before RNA replicators. We do know, however, that the very

first thing in the planet's history that deserves to be called alive needed an autocatalytic mechanism to still its hunger" (pp. 54–55).

"We do not yet know how life evolved all this complexity from its simple origins, and we may never know for sure. The oldest single-celled fossils are as complex as modern cells, and their ancestors are shrouded in darkness" (p. 63).

Innovation in bacteria?

Wagner cites, as examples of evolutionary innovations, bacteria with never-before-seen biochemical capabilities. He cites *Sphingobium chlorophenolicum*, a bacterium that can live entirely on pentachlorophenol (PCP, C_6Cl_5OH), an antifouling chemical first made by humans in the 1930s. He also mentions bacteria that cannot only break down, but feed on, antibiotics, including man-made ones not found in nature.

The ability of an enzyme, or chain of enzymes, to break down a man-made substance is not in itself remarkable. By analogy, there is nothing remarkable about a dog able to chew a hole through a piece of man-made material (e.g. plastic). The same biomechanical actions of the tooth bite directed against natural targets (flesh or bone) can be directed against plastic. In like manner, the same enzymes that attack natural complex molecules by finding a 'kink' in them can find the same 'kink' in man-made complex molecules, effecting their breakdown.

The papers that Andreas Wagner cites[1] do not, on close examination, support evolutionary novelty. It turns out that he has essentially hyped a process that has nothing to do with the emergence of evolutionary novelty. Nothing new has been generated. Consider, by analogy, what happens when a player wins a card game. It occurs because he got a winning combination of cards. Notice what is and what is not novel. The combination is novel. None of the cards themselves are novel. All the cards in the game had been there from the very beginning of the game. No new cards, let alone new suites of cards, had been created de novo just before or during the game.

So it is with the bacteria, including those that broke down recently originated man-made chemicals. The bacterium that first broke down the chemicals did so because it had gotten the 'winning combination' of genes through horizontal gene transfer from other bacteria, and from recombination. All of the genes ('cards') had been pre-existent in the population of bacteria all along, e.g. tetrachlorohydroquinone dehalogenase, which degrades one of the breakdown products of PCP. No new genetic information ('cards') had been created to eventually cause the 'winning combination' to come up in bacterium.

Clearly, the foregoing examples of bacterial action are not evidence for any form of "arrival of the fittest" evolutionary novelty. All of the genes in the bacterial population could have existed since Special Creation, and no evolutionary explanation is necessary to account for the abilities of the bacteria to break down unusual chemicals.

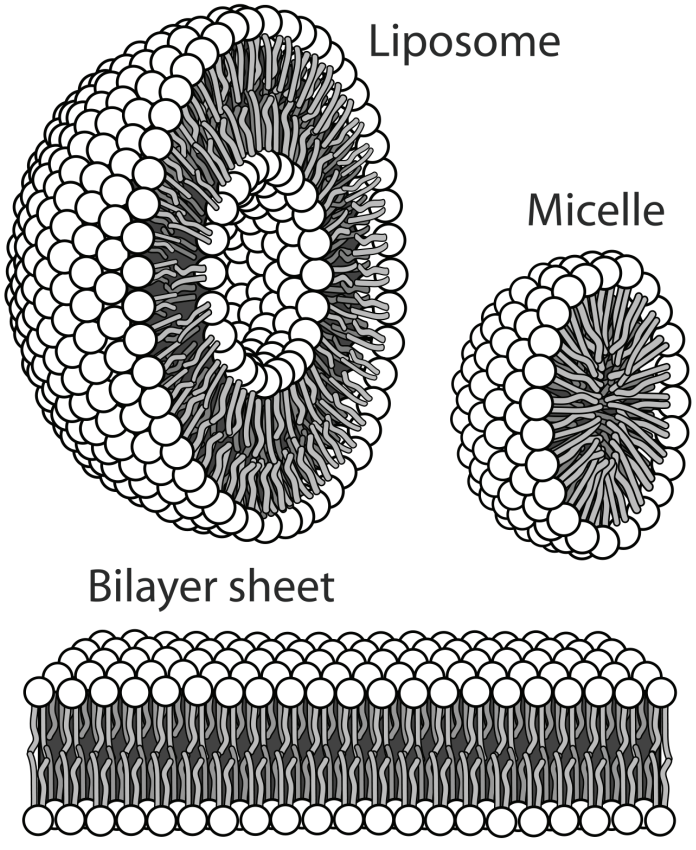


Figure 1. All evolutionistic origin-of-life scenarios are completely speculative. A believed key step for abiogenesis—life arising from non-living matter—is the formation of lipids into 'protocell' membranes.

Hox genes—multiple simultaneous changes

The author dusts off the example of Hox genes in order to illustrate how mutations can simultaneously affect many different components of the organism. However, it appears that this is a revival of the old 'hopeful monster' scenario. It certainly does not follow that simultaneous changes have

anything to do, at least necessarily, with the arrival of a more-fit organism. If anything, they would guarantee the appearance of at least one severely deleterious trait, causing the immediate elimination of the organism by natural selection. The same considerations would, of course, apply to any other putative mechanism that could cause simultaneous changes in the organism.

Let us, by analogy, consider the fact that extreme cold will change many of the mechanical and structural components of a car simultaneously. What does this do? Owing to the different degrees of contraction of various alloys, the mechanical and structural components are altered in numerous subtle ways. The hood fits a little less snuggly. A slight gap appears in the tailpipe. The door is a little too tight. The fluids are more viscous, so it is harder for the engine to turn over, and it is harder for the transmission to rotate the axles because of the gummy transmission oil. Owing to the congealing of power steering fluid, it is now harder for the driver to turn the steering wheel. The pistons are slightly looser. The battery puts out less power. And so on.

Of course, one could think of other processes (such as extreme heating, or a major collision) that would affect many systems of the car simultaneously. Regardless of the mechanism, one could think of myriads upon myriads of ways that a car and its components could be simultaneously altered, but it does not follow that any single one of these simultaneous changes would necessarily produce a better-functioning car, let alone a qualitatively different novel machine. Once again, we have no arrival of the fitter.

Evo-devo

The author touches on evolutionary developmental biology, which is commonly called 'evo-devo'. He suggests that it offers fantastic insights into how genes cooperate with each other like orchestra musicians, but that it offers no solid evidence for evolution. He quips,

> "So far, though, these insights have not yet added up to a theory rivaling the modern synthesis. And only theory can turn a heap of facts into a tower of knowledge. The culprit is once again the enormous phenotypic complexity of whole organisms. Even today, we struggle to fully understand the phenotype of even the simplest organism, and hundreds of thousands of biologists laboring over many decades have still not fully understood how genes shape this phenotype" (pp. 22–23).

RNA innovation?

Wagner, in common with many other evolutionists, posits a scenario wherein RNA was the original building block of life. According to this thinking, the DNA molecule was a later evolutionary add-on, and the currently observed co-dependence of RNA and DNA was a still more recent evolutionary development.

Consistent with the foregoing conjecture, Wagner has experimented with the RNA molecule. He claimed to have found that the RNA molecule is much more versatile than previously suspected. It can change from a 'splitter' to a 'fuser' function. The unexpected multiplicity of functions of RNA, in and of itself, tends to support the RNA-first scenario. Does it necessarily, even leaving aside the huge problems of forming a very unstable molecule like RNA in a primordial soup?[2]

Let us consider the analogy of the car thief doing his work on an automobile. He finds that he can hot-wire the car and drive it away. Should the evolutionist get excited about the fact that there are two completely different ways (at least) to start the car and drive away with it? Furthermore, that car's specific keys can be bypassed in order to start and operate the car. Better still, no key of *any* kind is needed to start and run the car. Would the evolutionist think that keys were a later evolutionary add-on to the car? Should the evolutionist engage in triumphalism, proclaiming that no intelligent designer is needed to account for the existence of cars?

Assumed evolutionary innovation

At times, the author's reasoning degenerates into the same old evolutionary thinking: A living thing exists, therefore it evolved. Instead of showing examples of (alleged) evolutionary novelty, Wagner merely *assumes* that evolutionary novelty had occurred in the past. Thus, when he discusses the varied biochemical cold adaptations of Arctic and Antarctic fish, he just infers that an evolutionary innovative process has produced these adaptations sometime in the past. However, it's not a great feat to be an antifreeze protein—any junk sequence will do as long as it has one end to bond to water molecules and another to repel other water molecules, preventing them condensing together into ice crystals.[3] Moreover, he tacitly admits that his reasoning is based on conjecture as he falls back on the customary evolutionary storytelling,

> "The ability to protect against freezing may not have arisen abruptly but gradually, where some amino acid changes increased a protein's ability to protect against freezing to a small extent, until today's antifreeze proteins had formed" (p. 238).

And they lived happily ever after.

Another outright example of *post-hoc* evolutionary reasoning involves the presentation of a cladogram that shows the amino acid differences in the hemoglobin of the human, chimpanzee, mouse, and chicken (p. 121). Once again, this does not demonstrate evolutionary innovation or the arrival

of the fittest. It *assumes* evolutionary innovation and *assumes* the arrival of the fittest as a long-ago evolutionary outcome.

As mentioned earlier, the author brings up the evolution of the eye. Instead of offering anything new, he only repeats the *ad hoc* time-worn tale of the eye evolving in gradual steps, although he stresses that this in no way takes away from his ideas.

Globin oxygen-binding variants: novelty or semantics?

The author dwells on the many different forms of globins among living things. All of them can bind oxygen (figure 2). There are globins not only in vertebrates, but also in worms, mollusks, insects, sea stars, and plants. Obviously, any consideration of their diversity, as coming from a common ancestor, already assumes that evolution has taken place.

Even if one accepts evolution as the explanation for all living things, one must ask what actually constitutes an innovation. Wagner realizes this, and it is obvious that a diagnosis of novelty at least partly rests upon a prior belief in the evolutionary process. Thus, he writes,

> "A subtle philosophical question is what constitutes different solutions to the same problem. A chemist may argue that two proteins different in their amino acid sequence but cleaving a small molecule with the same reaction mechanisms are similar solutions, whereas two proteins that use a different reaction mechanism are different solutions. From an evolutionary perspective, however, it is sensible to view all genotypes that serve the same function as different solutions to the same problem, because each of these phenotypes can, in principle, be discovered independently from other genotypes" (p. 240).

Modified functions do not imply a non-intelligent cause

The author presents a number of examples of the varieties of proteins that work. He does the same for other biological systems. All this he takes as proof that there are many solutions to a biological program and that, by implication, no intelligent designer is needed. Is this so?

Since Wagner likes analogies, permit me to make this one. Consider the gas-powered lawnmower. It could be modified in hundreds of ways (and at least thousands of changes in assortment) and still function. We could, for instance, vary the lengths of the electrical wiring, gasoline-feed tubing, lawnmower handle, etc. In addition, we could use wires composed of many different metals and their alloys, and do the same with the gas-feed tubing with regards to the many different plastics or rubber-based compounds that it could be made of. We could use many different compositions of string, and non-string materials, to serve as the cord for the pull-starter.

Let us keep going. We could substitute an astonishing variety of petroleum-based fuels for the gasoline. We could, to a degree, change the shape of the housing that contains the motor. We could substitute one style of sparkplug for other styles. We could, to a degree, change the size of the wheels, and completely replace the existing wheels with wheels variously made of solid rubber, hollow (pneumatic) rubber, wood, ceramic, differing metals and alloys of them, etc. We could replace the wheels entirely with caterpillar threads. And so on, ad infinitum.

However, none of these changes, nor still others that could be imagined,

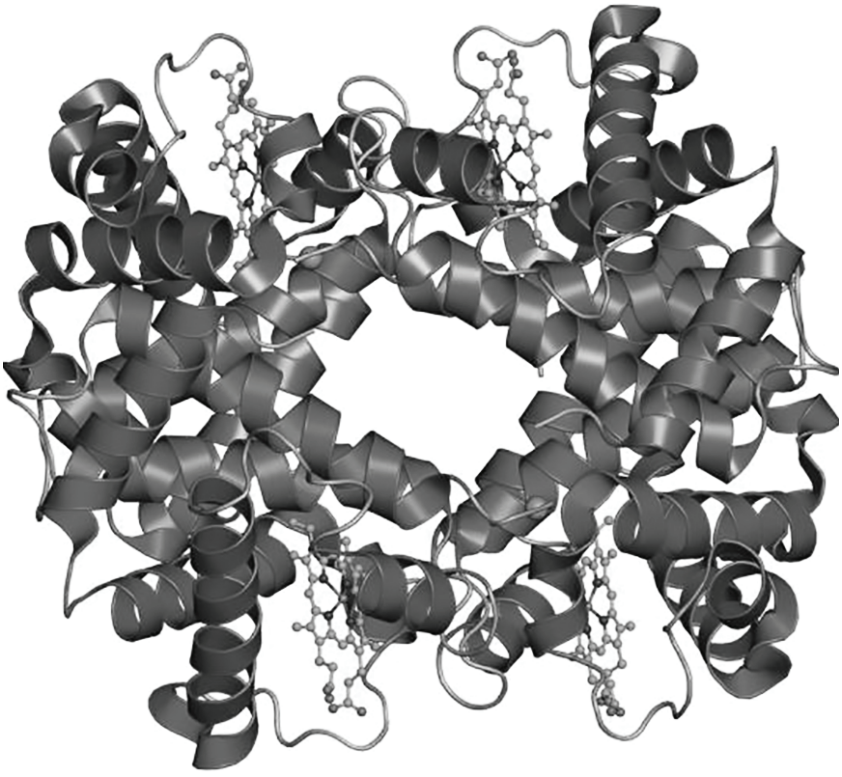


Figure 2. A visual representation of just some of the complexities of the oxygen-binding globin molecule.

would have any bearing in terms of an explanation of how the lawnmower could have originated from a spontaneous, non-intelligent cause. In like manner, the great variety of functional metabolic pathways, protein modifications, etc., do not, at least by themselves, explain how these systems could have originated from a spontaneous, non-intelligent evolutionary cause.

As a matter of fact, Wagner tacitly admits that, even within the context of evolutionary theory, there is no straightforward way of assessing the role of presumed evolutionary innovations,

> "While life has discovered some innovations more than once, it may have discovered others only once, but the genotypes encoding them may have diversified later beyond recognition. In some systems, for example proteins where current genotypes are extremely diverse, it is difficult to distinguish multiple independent origins from a single origin followed by diversification" (p. 254).

Are loss-of-information mutations innovations?

In common with many evolutionists, Wagner tries to pass off a loss of function, which happens to enhance the survivorship of the organism in some specialized environment, as a beneficial mutation. For instance, he cites the tighter binding of oxygen to the hemoglobin, and how this helps the human body function at high altitudes, where oxygen pressure is low.

As another example, he brings up that the sickle cell is normally less efficient in oxygen transport than a normal one, but the sickle cell trait is beneficial in that it enhances its bearer's fitness in a high-malaria environment. But it does this by a 'scorched earth' tactic: the malarial parasite causes the red blood cell to 'sickle', and the spleen destroys this cell with the parasite inside. Thus the host is still down by one red blood cell.

What does all this mean? Let us return to the lawnmower analogy. Accidental damage (a 'mutation') occurs to a wire, and the electricity in it now arcs, producing some illumination. The 'mutation' is beneficial, as the low-level illumination it produces now allows for the lawn mowing to start slightly earlier, at dawn, and to end slightly later, at dusk. Of course, the 'mutation' may also qualify as a loss-of-function one, as the competition for voltage may now cause the spark plug to misfire, making the overall lawn mowing task less, not more, efficient. However, the earlier start and end times may still create a net increase in the 'fitness' of the lawnmower. Using a little evolutionary imagination (and I emphasize the word 'imagination'), one could envision additional 'beneficial mutations' that correct the spark-plug problem and further enhance the illumination, allowing the lawn mowing to start even earlier and end even later.

Is the foregoing electric-arcing 'mutation' profound, or is it trivial? Does it, in any case, have any bearing on how the lawnmower supposedly originated by spontaneous, non-intelligent processes? Hardly. Neither do individual instances of arguably beneficial mutations.

Genotype networks—neutral theory expanded

Evolutionists always tell us that complex structures in living things do not arrive in one step—like jumping to the top of the mountain from its base. (This follows the 'Climbing Mount Improbable' analogy of Richard Dawkins.[4]) Instead, minor beneficial mutations are preserved by natural selection. This selectionist process occurs over and over again—like climbing a mountain step by step until one arrives at the summit.

By contrast, the neutral theory of evolution posits that evolution is mainly driven by neutral mutations. A whole series of mutations accumulate that are neither fixed nor eliminated by natural selection. Eventually, a new neutral mutation interacts with a pre-existing neutral mutation, and the joint effect of their expression increases the fitness of the organism that bears them. Natural selection then favours the preservation of the combination of mutants.

The problem with the neutral theory is obvious. Because a fortuitous confluence of mutations is needed to benefit the organism, this process returns the situation to the jumping-to-the-top-of-themountain-in-one-step.

Andreas Wagner revives the decades-old neutral theory of evolution with a twist. He focuses on genotype networks. This is supposed the increase the probability of the emergence of a beneficial fortuitous combination of neutral mutations getting juxtaposed with each other, thereby increasing the fitness of the organism. Does it? To expand the analogy of jumping from the base to the summit of the mountain in one step, there are now many mountains that are candidates for jumping, and not just one. The person can now jump from the base to the summit, in one step, of *any* mountain on planet Earth, and this will count as a success. Is this, however, really appreciably more likely to happen than jumping from the base to the summit on one specified mountain on Earth?

Let us now pursue the analogy used by Wagner. He says that it is not hard for one needle to find another needle in the haystack, because the haystack has many needles. What if, notwithstanding this fact, it is still vanishingly probable for one needle to encounter another needle?

The author's abysmal ignorance

The author's conception of the scientific creationist position is beyond pathetic. He actually states (p. 9) that creationists believe that the world was created on a Saturday night in October of 4004 BC. For his elementary information, no modern mainstream creationist believes that!

It gets even better, saying Noah's Ark had saved more than a million species [no doubt including insects and fish], but had forgotten the dinosaurs. This shows his zero understanding of the matter.

Conclusions

The title of the book claims much more than it delivers. Most of the author's proposals are scenarios, while others are *ad hoc* evolutionary conjectures based on the diversity of biochemical and other life processes. Wagner has a tendency to focus on relatively minor matters and blow them all out of proportion. Still other proposals by the author assume the arrival of the fittest as an outcome. They most certainly do not demonstrate it.

References

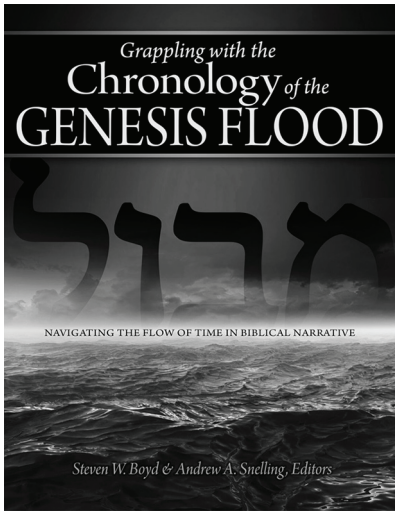
1. For example, see Copley, S.D. *et al.*, The whole genome sequence of *Sphingobium chlorophenolicum L-1*: Insights into the evolution of the pentachlorophenol degradation pathway, *Genome Biology and Evolution* **4**:184–198, 2012. Van der Meer, J.R. *et al.*, Evolution of a pathway for chlorobenzene metabolism leads to natural attenuation in contaminated groundwater, *Applied and Environmental Microbiology* **64**:4185–4193, 1998.
2. Even proponents of the RNA world admit that it has plenty of holes, but claim that it's still better than other theories of chemical evolution, which is saying very little apart from their *a priori* commitment to materialism—Bernhardt, H.S., The RNA world hypothesis: the worst theory of the early evolution of life (except for all the others), *Biology Direct* **7**:23, 13 July 2012, doi:10.1186/1745-6150-7-23.
3. Doyle, S., Antifreeze protein evolution: turning wrenches into hammers, *J. Creation* **25**(2):14–17, 2011.
4. See Sarfati, J., Review of Climbing Mount Improbable, *J. Creation* **12**(1):29–34, 1998; creation.com/dawkins.

Detailed analysis of the Hebrew text of the Genesis Flood

Grappling with the Chronology of the Genesis Flood

Steven W. Boyd and Andrew A. Snelling (Editors)

Master Books, Green Forest, AR, 2014



Michael J. Oard

I have always been uncertain about the meaning of several words and phrases in Genesis 6 to 9. These include the two mechanisms of the Flood, 'the fountains of the great deep' and 'the windows of heaven', as well as the chronological order of the narrative. I am also uncertain about exactly when the Flood peaked and what is meant by the word 'prevailed'. Little has been written on the chronology of the Flood, and this very scholarly book admirably fills that gap with 756 pages of text, not counting the glossary and three indexes. References are located at the end of each of the 16 chapters.

This book does an extensive analysis of the Hebrew in Genesis 6 to 9, but it is not an easy read. The interpretive challenge is discussed by the ingenious method of using the backdrop of a seafaring voyage. The authors address basic questions like the temporal chronology of the narrative as a whole and the dividing of the verses into episodes and scenes. They do not declare which of the three main positions the Hebrew favours for the peak of the Flood: (1) it peaked on Day 40 and decreased slowly, (2) it peaked on Day 150, or (3) it peaked on Day 40 and remained steady state until Day 150. They do mention the majority of scholars have accepted the second position. Of course, a majority opinion does not mean it is necessarily true. Unfortunately, the book does not answer, or provide meaningful possibilities, for the rest of my questions. Hopefully, they will be addressed in two sequels, which are planned.

The chronology of the Flood

Boyd and Snelling's key point is the verb form of *wayyiqtol*. It is commonly used to show a temporal sequence in Hebrew verbs and verb phrases in narrative but does not necessarily mean a temporal chronology. This is discussed throughout the volume and is the main thrust of chapter 10, where they explain that a strict temporal sequence for *wayyiqtol* became an assumption about the year 1900. Nevertheless, there are dozens of obvious exceptions in the Old Testament. Other aspects of the narrative must be analyzed to derive the temporal sequence:

> "… individual events of the Flood narrative depend not on the presence or absence of the *wayyiqtol*, but on other contextual and linguistic factors" (p. 356).

The assumption that Genesis 6 to 9 is a strict temporal sequence has resulted in several absurdities. Among them is that Noah would have had to enter the Ark three separate times, in Genesis 7:7, 13, and 15. Unfortunately, the temporal assumption reinforced the Documentary Hypothesis, which claims the first five books of the Bible are a compilation of four or more authors or traditions, and that Genesis 6 to 9 was cobbled together by two or possibly three of these authors. According to the hypothesis, later an editor put the accounts together into one. Recognizing that the *wayyiqtol* is not always sequential pulls the rug out from under the Documentary Hypothesis.

Further principles of Hebrew grammar indicating temporal order are developed in chapters 11 to 13. In chapter 14, this enables the authors to subdivide the narrative into three episodes and 18 scenes. Each scene represents a narrative unit. Non-negotiable fixed chronological points are defended. They include Genesis 7:1, the beginning of the Flood and the age of Noah; Genesis 8:4, the Ark grounding at 150 days; Genesis 8:5, the tops of the mountains being observed; Genesis 8:13, Noah's age when the waters had dried up and he removed the covering of the Ark; and Genesis 8:14, the age of Noah when the earth was dry.

Along the way, we are given an analysis of the various extant manuscripts of Genesis 6 to 9. As the authors stress, it is necessary to know the original Hebrew before we can analyze the chronology. As it turns out the Masoretic and Samaritan Pentateuch texts are the best for this purpose. The Septuagint apparently has difficulties. The authors also list and analyze opinions on Flood chronology. They mention the elaborate chiastic structure[1] of the Flood account, but they indicate the structure is not absolute.

Geological and geophysical issues

Chapters 5 to 7 interrupt the Hebrew analysis to discuss geological and geophysical issues. The chapters present one model of the Flood, but the analysis of the Hebrew can be incorporated into other Flood models as well. Chapters 5 to 7 appear to be an unnecessary intrusion into a book, the main theme of which is Hebrew chronology. There is much I can agree with in these chapters. Chapter 5 is a good history of Flood and secular geology. I agree the relative sea level, the level of the floodwater, oscillated; the mountains rose late in the Flood; and the Flood waters regressed after Day 150, followed by a post-Flood rapid Ice Age. Reasons for the general fossil order in sections 4 to 6 of chapter 7 are particularly praiseworthy.

Many Flood geologists will disagree with some aspects of the geological and geophysical model the book presents. Some will take issue with catastrophic plate tectonics (CPT) and question whether the geological column represents an absolute temporal sequence of biblical earth history. Also disputed is whether the pre-Flood/Flood boundary is just below the Precambrian/Cambrian boundary of the geological column. North American megasequences are considered absolute, and the Flood/post-Flood boundary appears to be somewhere between the Cretaceous/Tertiary and the mid Tertiary. Boyd and Snelling declare a consensus among creationists on the pre-Flood/Flood boundary where there is none. Froede and I have demonstrated the pre-Flood/Flood boundary is equivocal.[2,3] The Cambrian[4] strata could not have been deposited immediately after the beginning of the Flood since they are the bottom layer of a thick, widespread layer of Paleozoic and Mesozoic strata that has very little

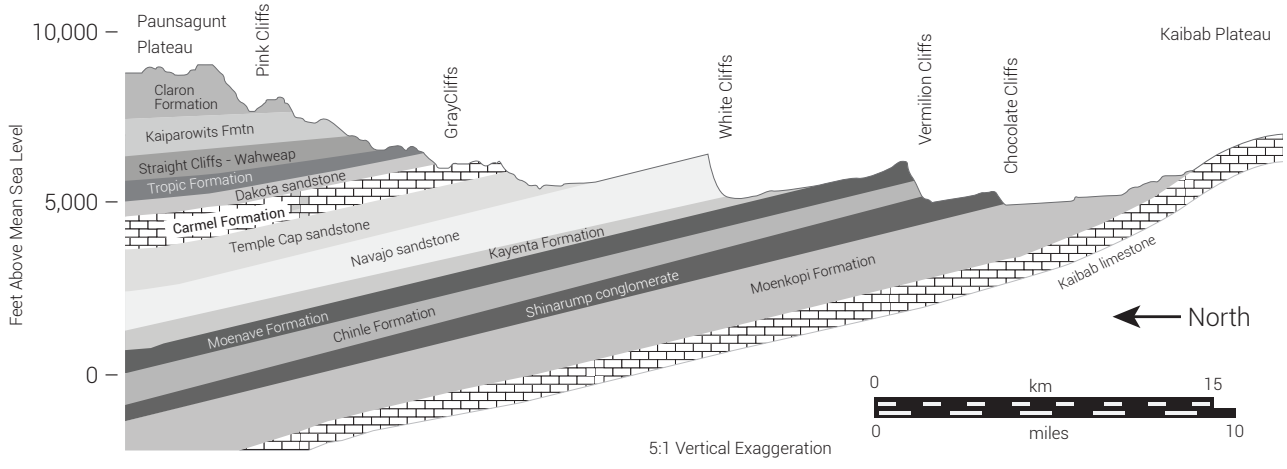


Figure 1. Schematic of the Grand Staircase north of Grand Canyon, which is located near the top of the anticline of the Kaibab Plateau (drawn by Peter Klevberg).

deformation. This would imply the catastrophic mechanism that began the Flood waned by the time the Cambrian layer was laid. Although *Grappling with Chronology* is dogmatic about the geological column, it admits the considerable contention that exists concerning the Flood/post-Flood boundary. In my opinion, the defense of the location of the Flood/post-Flood boundary is superficial.

Chapter 6 of the book admits CPT is a working model but holds onto it dogmatically. It claims 'only' CPT can explain the geological and geophysical observations, North America megasequences, mountain building, and how the continents down buckled in areas where they proceeded to collect sediments. Indeed, CPT does explain some evidence, but numerous details, some of which seem contradictory, have yet to be worked out.[5] One questionable claim is that CPT caused mountain uplift, yet there are many mountain ranges, like the Ural and Transantarctic Mountains, that do not readily fit into the CPT paradigm, unless there were paleo subduction or paleo continental collision zones.

Especially troubling to me is that Walker's biblical geological model is summarily rejected.[6,7] His model has powerful explanatory value. He classifies the Flood into stages and phases, proposing the Genesis Flood was like a flash flood that can be divided into two main stages, the Inundatory and Recessive Stage. These two stages he subdivides into phases. He proposes that when the mechanism of the Flood was unleashed the water rose quickly (the Eruptive Phase). Then it continued to rise slowly or 'prevailed' (the Ascending Phase). At the peak of the Flood the waters began to recede and rush off of the continents. At first they formed wide currents (the Abative or Sheet Flow Phase) which eventually transformed into more narrow currents (the Dispersive or Channelized Flow Phase). Geomorphology, the study of the earth's surface, gives supportive evidence for a sequence of sheet flow followed by channelized flow.[8,9]

I am convinced Walker's classification is rejected since it does not strictly adhere to the geological column. If Walker's model is correct, the geologic column would need to be modified. As Walker fleshed out his model, he mentions that dinosaur tracks would define strata formed early in the Flood before the water covered the Earth. Some advocates of the K/T boundary model believe the Mesozoic is middle or late Flood. Mesozoic strata have billions of dinosaur tracks and millions of eggs. These represent live dinosaurs that had to have been dead by the peak of the Flood.[10] Tracks and eggs are usually found in areas of thick sedimentary rocks along with evidence hundreds of metres of erosion exposed the trace fossils. All of the fossilized dinosaurs' activity can be placed between Day 40 and Day 120, during the Ascending Phase of the Flood, because the first 40 days of rain would have washed away their tracks. The dinosaurs had to have been dead well before the time the continents were eroded, at the start of the Recessional Stage. Dinosaur tracks and eggs also show that the peak of the Flood could not have been at Day 40, also indicating practically all the geological column was deposited on the continents before Day 150.

Evidence for the geological column is provided by strata in the Grand Canyon and the Grand Staircase (figure 1). Agreed, this is an ordered sequence of the Paleozoic up until the early Cenozoic. However, advocates of an absolute geological column need to look beyond this area. The geological column has to apply over the *entire* Earth—continents as well as the ocean bottom. Creation scientists need to do much more analysis of how the geological column applies to biblical earth history. Reading Dr Reed's and my book is a good place to begin.[11] It presents both sides of the argument, for and against the geological column.

Flood geology needs the same extensive analysis the rest of Boyd and Snelling's book provides. Our Flood models must be backed up with a large body of published research in the areas of geology, geophysics, paleontology, and geomorphology. I have attempted to do so with the Flood/post-Flood boundary. Recently, I published an e-book defending the location of the boundary at the Late Cenozoic.[12]

References

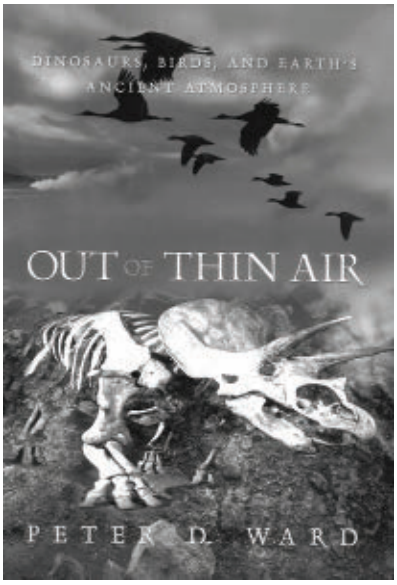
1. A chiastic structure is a literary technique in which two or more clauses are balanced against each other by a reversal of their structure. In the case of the Flood account, the chiastic structure is balanced around Genesis 8:1a: "But God remembered Noah …".
2. Froede Jr, C.R. and Oard, M.J., Defining the pre-Flood/Flood boundary within the Grand Canyon: were all the pre-Flood sediments scoured down to basement during the Flood? *Creation Matters* **12**(4):3–4, 6, 2007.
3. Oard, M.J. and Froede Jr, C., Where is the pre-Flood/Flood boundary? *Creation Research Society Quarterly* **45**(1):24–39, 2008.
4. The geological column is used for discussion purposes only.
5. Reed, J.K. (Ed.), *Plate Tectonics: A Different View*, Creation Research Society Books, Chino Valley, AZ, 2000.
6. Walker, T., A biblical geologic model; in: Walsh, R.E. (Ed.), *Proceedings of the Third International Conference on Creationism*, technical symposium sessions, Creation Science Fellowship, Pittsburgh, PA, pp. 581–592, 1994.
7. biblicalgeology.net/.
8. Oard, M.J., *Flood by Design: Receding Water Shapes the Earth's Surface*, Master Books, Green Forest, AR, 2008.
9. michael.oards.net/GenesisFloodRunoff.htm.
10. Oard, M.J., *Dinosaur Challenges and Mysteries: How the Genesis Flood Makes Sense of Dinosaur Evidence—Including Tracks, Nests, Eggs, and Scavenged Bonebeds*, Creation Book Publishers, Powder Springs, GA, 2011.
11. Reed, J.K. and Oard, M.J. (Eds.), *The Geologic Column: Perspectives within Diluvial Geology*, Creation Research Society Books, Chino Valley, AZ, 2006.
12. michael.oards.net/PostFloodBoundary.htm.

A story about the evolution of life and changing levels of oxygen on Earth

Out of Thin Air: Dinosaurs, Birds and Earth's Atmosphere

Peter D. Ward

Joseph Henry Press, Washington, D.C., 2006



John Woodmorappe

This book is a free-flowing, imaginative outline of how Earth's supposedly changing oxygen levels had affected (even governed) the evolution and extinction of living things in Earth's history—as interpreted by uniformitarianism. Ironically, the "out of thin air" in the title may apply in a manner that the author had not intended. Since this book is now several years old, and requires some background knowledge of computer-derived geochemical modelling, I introduce some more recent, and supplementary, information into this review.

For purposes of this review, I treat the geologic periods, and the purported evolutionary events during those periods, as if they were real. I provide a synopsis of these events, and finally examine the geochemical modelling used to deduce the supposed changes in the oxygen content of the earth's atmosphere in the distant past.

The author realizes that past O_2 levels, contrary to earlier beliefs, can not be directly measured (as by air bubbles trapped in amber: p. 37). Instead, he relies on GEOCARBSULF, a computer program—developed by Robert Berner and colleagues—that models the earth geologically and geochemically in order to arrive at estimates of past atmospheric oxygen levels. Using some recently published scientific material, I elaborate on some of the questionable features of this kind of modelling in the latter part of this review.

Speculative evolutionary hypotheses

The reader should be aware, before reading any further, that the biological interpretations presented in this book are highly conjectural. Author Peter D. Ward admits as much:

> "It will be up to scientists to see how many of these new hypotheses offered in this radical revision of Earth's history are accepted. If even a few are ultimately accepted, it will mean that we will have to revise our understanding of the *whys* in the history of life. If oxygen has varied through time along the lines that Robert Berner and others suggest, it seems highly likely that organisms would adapt in varied ways to these different conditions [emphasis in original]" (pp. 234–235).

The author speculates that the origin of tetrapods was related to changes in oxygen, and uses the word scenario to describe the effects of the Devonian high-oxygen peak (p. 102). His choice of words is excellent. Ward then relies on a 'molecular clock' to deduce when the lung fish and primitive amphibians had separated, but acknowledges that there is no direct evidence for any role of atmospheric oxygen levels:

> "And just how terrestrial *were* those first tetrapods? Could they walk on land? More importantly, could they breathe in air without the help of water-breathing gills as well? Both genetic information and the fossil record are of use here. But in some ways we are very hampered. Not until we somehow find the earliest tetrapods with fossil soft parts preserved will we be able to answer the respiration question [emphasis in original]" (p. 100).

Atmospheric O_2 levels—an all-purpose explanation

The author 'reads' virtually the entire evolutionary history of Phanerozoic life through the 'lens' of inferred changes in atmospheric oxygen. Owing to the fact that he presents so many topics, I can only focus on a few of them.

Ward contends that major extinctions are governed by low atmospheric oxygen levels. However, as if to cover all bases, he also suggests that extinctions can be driven not so much by the low levels of atmospheric oxygen, but by *changes* in atmospheric oxygen (p. 49). He relies on this seesaw many times in this book.

The relative shortage of oxygen, as during the Early Cambrian and the Early Triassic, is supposed to have created selective pressures that led

to evolutionary novelty, such as the Cambrian explosion and the appearance of dinosaurs. This, to begin with, assumes that environmental stressors are what drives evolutionary novelty. What if, instead, environmental stressors tend to inhibit evolution? What if, more fundamentally, evolutionary novelty is driven more by the kinds of mutations that occur than by the kinds and/or severity of environmental stressors?

Interestingly, the relative shortage or abundance of atmospheric oxygen can lead to diametrically opposite conclusions as to its purported evolutionary impact. Thus, Ward believes that the pneumatic bones in saurischian ('lizard-hipped') dinosaurs, such as *T. rex* and *Brachiosaurus*, were an adaptation to the low atmospheric levels of oxygen at the time that these dinosaurs originated (p. 180; the ornithischian ('bird-hipped' dinosaurs show no evidence of pneumaticity)). However, Robber Bakker, another iconoclastic dinosaur scientist, had earlier suggested that pneumatic bones were an adaptation to, or at least a feature strongly consistent with, *high* atmospheric oxygen levels (p. 176).

The extant *Nautilus* serves as a model for the extinct ammonoids. It lives in highly oxygenated waters. Perhaps ironically, the cephalopod conch is believed by Ward to have been a superb adaptation to the low oxygen levels of an earlier time (p. 217).

The Carboniferous—implications of high oxygen levels

One of the most dramatic features of the 'oxygen curve', as deduced from computer modelling, is the 'hump' in atmospheric oxygen at the time of the Carboniferous. By some estimates, atmospheric oxygen could have been as high as 35%—nearly double that of today.

The author notes that one of the most important determinants of relative oxygen concentration in the atmosphere is the amount of reduced carbon, from dead plants and animals, available to react with the oxygen (p. 37). One of the main 'forcings' modelled by GEOCARBSULF is that caused by the inferred burial rates of organic carbon (p. 38). When it comes to the inferred peak of atmospheric oxygen during the Carboniferous, Ward comments:

> "When a great deal of organic matter is buried, oxygen levels go up. If this is true, it must mean that the Carboniferous period, the time of Earth's highest oxygen content, must have been a time of rapid burial of large volumes of carbon and pyrite, and evidence from the stratigraphic record confirms that this indeed happened—through the formation of coal deposits" (p. 116).

The potential for circular reasoning is obvious. The high Carboniferous levels of atmospheric oxygen are, at least in part, inferred from the large amounts of organic carbon sequestered in coal. Then we are told that the large amounts of Carboniferous coal are predicable from the inferred high atmospheric O_2 levels!

Let us, however, assume that no circular reasoning is involved in the inference of high atmospheric oxygen during the Carboniferous. Ward mentions, but glosses over, many problems with this idea.

A high level of atmospheric oxygen would tend to inhibit plant growth. Ward acknowledges no evidence that such was the case. If anything, the presence of tree ferns, and other lush foliage (figure 1) that is obvious to students of Carboniferous paleobotany, would tend to contra-indicate such a situation.

The author acknowledges that huge fires could have been a problem, but glosses over them with the explanation (or rationalization) that the vegetation, being of a wetland nature, was resistant to burning. In addition, bark was thicker, making trees more resistant to burning. Was it? If oxygen levels were high enough, materials would be so combustible that their moisture content and thickness of the bark would be largely irrelevant.

In addition, the author glosses over the self-intensifying nature of fires. As fires get larger, their convection brings in more oxygen to feed the fire. How much more easily, and more intensely, would this feedback loop progress in a higher-oxygen environment? How much more effective would firebrands be, in spreading even a geographically stabilized fire, when operating in an enriched-oxygen environment?

Figure 1. The Carboniferous was supposed to be a time of extensive vegetation, which is not exactly consistent with a much higher atmospheric oxygen environment.

There is also the unmentioned question of firestorms (figure 2). As a fire grows large enough, the rate at which superheated air rises away from the fire is more than offset by the new superheated air that is being generated by the massive fire. Consequently, a permanent layer of superheated air exists over the entire area, radiating heat back downward, and igniting virtually everything combustible situated beneath it. How much larger, more common, and more intense would firestorms be in a higher-oxygen environment?

The issue of mass fires and firestorms has an additional implication. If sufficient material is burned, and the smoke lofted into the upper troposphere and lower stratosphere as large fires are known to do, a 'nuclear winter' effect is created. Sunlight is blocked, on a near-global scale, to an extent sufficient to prevent plants from growing for several years. Thus, we would likely expect the high-oxygen Carboniferous biosphere to be repeatedly self-annihilating, and therefore self-refuting.

The author speculates that the large size of Carboniferous insects owed to the high oxygen levels at the time. Ward mentions some lab experiments that indicate that insects grow larger in a high-oxygen environment—but some, such as cockroaches, do not.[1] However, he acknowledges that not everyone is persuaded that the high inferred levels of atmospheric oxygen had anything to do with the large size of insects in the Carboniferous. The argument was stronger when entomologists thought that insects didn't 'breathe' but relied on oxygen diffusion. But it has now been proven that insects really do breathe after all, so the main argument collapses.[2]

Computer modelling—GEOCARBSULF uncertainties

The reader is probably familiar with the 'global warming' debate, which 'warmists' (or 'warm-mongers') earnestly would have us believe is a settled issue. One of the issues has been the limited ability of sophisticated computer programs to predict weather and climate. Much the same questions can be raised about any computer models of the earth's past, including GEOCARBSULF.

A detailed analysis of GEOCARBSULF has recently been published.[3] It is revealing. GEOCARBSULF depends upon a plethora of modelled processes. This includes the inferred chemical weathering of calcium– and magnesium-rich silicate rocks, as these are a critical sink for atmospheric carbon dioxide. Various processes are assumed to be time-dependent or time-invariant. The number of exposed rocks of various kinds, critical for geochemical modelling, is derived from paleogeographic maps. (The informed reader probably realizes that paleogeographic maps are quite subjective.[4]) Continental ice sheets are assumed to have occurred only at specified, known times. Large vascular plants are assumed to have accelerated weathering rates at a prescribed rate. The rate of weathering caused by gymnosperms, relative to angiosperms—admittedly poorly constrained to begin with—is included in the calculations. In addition, angiosperms are assumed to have phased in linearly during the time interval of 130 to 80 Ma ago.

Computers do not think. They only crunch numbers—hence the saying GIGO (Garbage in, Garbage Out). Let us consider the implications of GIGO. The authors are frank about the data behind the modelling, "Quantitative uncertainties for most input parameters in GEOCARBSULF are poorly known."[5] In addition:

> "Second, many equations in GEOCARBSULF are based on parameterizations. That is, the equations are built on correlations and do not include an explicit physical description of the underlying process (for example, the dependence of continental weathering as a function of climate, the dependence of global air temperature as a function of CO_2)."[3]

An eye-opening GEOCARBSULF Monte Carlo analysis

Most interesting of all, this study has examined 68 input parameters in GEOCARBSULF, and subjected them collectively to a Monte Carlo analysis, featuring both the individual and

Figure 2. A forest fire can develop into a firestorm. In a higher-oxygen atmosphere, such firestorms would be much larger, and much more common.

collective variances. It did so with an assumed Gaussian distribution of results. Even then, the study makes two crucial assumptions: that GEOCARBSULF is not missing any key processes, and that the parameter means are correct[2].

Even granting the assumptions, the results of the Monte Carlo analysis are unambiguous. Nearly all the 'peaks' and 'valleys' of atmospheric O_2 content are more or less 'washed out'. The inferred high Carboniferous atmospheric oxygen levels remain. However, even these could be reconciled with a largely unchanging atmospheric O_2 level, over time, if some of the factors were shifted in one direction.[6] The inferred drop of oxygen, near the Triassic-Jurassic boundary, is also believed to be left standing.

There's more. Earlier error envelopes for the GEOCARBSULF oxygen curve, over time, had been 'best guesses',[7] and the new error envelopes of the Monte Carlo analysis are much greater than the earlier-conjectured ones. One need only glance at the guesstimated error envelopes shown by Ward (p. 30) with the calculated 95% confidence envelopes of this new study.[8] The 95% confidence envelopes overlap the 21% oxygen, of today's atmosphere, for almost the entire Phanerozoic time interval!

The error ranges, indicated by the Monte Carlo analysis, are staggering. At 95% confidence levels, the Carboniferous 'hump' spans 22–44% oxygen, the Triassic-Jurassic boundary 'trough' spans 7–18% oxygen, and the Early Cambrian 'low' spans 13–23% oxygen.

The new study also examines inferred past CO_2 levels, and the authors claim that the GEOCARBSULF calculations compare favorably to independent records, from proxies, for the Paleozoic through early Mesozoic. However, the supposed agreement is much less so for the time interval of 200 to 30 Ma ago.[9] Considering that the latter includes some of the most noteworthy evolutionary deployments featured by the author (diversification of dinosaurs, birds, etc., and the appearance of large mammals), this takes on further significance.

COPSE and GEOCARBSULF agreement?

The author claims that the atmospheric gas levels indicated by GEOCARBULF are broadly corroborated by the results of COPSE, another computer model of the earth's past (p. 39). However, a more recent scientific source[10] is instructive. It turns out that COPSE and GEOCARBSULF share many of the same input parameters and inferred forcings.[11] For this reason alone, it is doubtful if the 'conclusions' of the two models are independently derived, and if the intervals of concordance are necessarily significant.

In addition, close examination of the two models shows considerable disagreement between the two models in some parts of the Phanerozoic timescale. The inferred RCO_2 (relative carbon dioxide) for 420–500 Ma ago, which is 8–10% according to GEOCARBSULF, is glaringly contradicted by the 16–18% indicated by COPSE.[12] Another major contradiction between the two models is for 380–500 Ma ago, and is applicable to RO_2 (relative oxygen). The GEOCARBSULF results trend near 1.0, while that of COPSE trends near 0.3.[13]

The time interval of 380–500 Ma ago is believed, by evolutionists, to be a time of pivotal evolutionary changes in living things. For instance, Ward discusses the Ordovician 'rebound' that followed the Cambrian extinctions, the appearance of the first land-dwelling arthropods, the appearance of the first land plants, and the inferred transition from fish to the first amphibians. For this reason, the contradictions between the two models, for 380–500 Ma ago, take on additional significance.

Conclusions

This book has some value for at least two reasons. Its free-flowing, relatively non-technical narrative provides a readable history of life, as imagined by evolutionists, for the layperson. It also provides insight on the oxygen needs of different organisms.

The computer modelling used in this work raises all the questions about computer modelling of the earth in general. The large margin of error for inferred past oxygen levels makes their uses questionable for understanding of past life on Earth, even in an evolutionary-uniformitarian context.

It is obvious that the atmospheric modelling, as presented in the book, has no direct bearing on creationist models. Apart from all its built-in dubious features, the modelling assumes the reality of geologic periods. It takes for granted a steady-state uniformitarian Earth where mountains are built and eroded, organic matter gradually accumulates or is destroyed, seafloor spreading takes place (and at very slow rates), and so on.

References

1. Raising Giant Insects to Unravel Ancient Oxygen, sciencedaily.com, 30 October 2010.
2. Westneat, M.W. *et al.*, Tracheal respiration in insects visualized with synchrotron X–ray imaging, *Science* **299**(5606):558–560, 2003 | doi:10.1126/science.1078008.
3. Royer, D.L. *et al.* Error analysis of CO_2 and O_2 estimates from the long-term geochemical model GEOCARBSULF, *American J. Science* **314**:1259–1283, 2014.
4. Oard, M.J., Beware of paleoenvironmental deductions, *J. Creation* **13**(2):13, 1999.
5. Royer *et al.*, ref. 3, p. 1275.
6. Royer *et al.*, ref. 3, p. 1270.
7. Royer *et al.*, ref. 3, p. 1260.
8. Royer *et al.*, ref. 3, p. 1269.
9. Royer *et al.*, ref. 3, p. 1276.
10. Mills, B.J.W., *Weathering Pathways and Limitations in Biogeochemical Models: Application to Earth System Evolution*, Ph.D. Thesis, University of East Anglia, 2012, ueaeprints.uea.ac.uk/45270/1/Mills_2012_thesis.pdf.
11. Mills, ref. 10, pp. 11 & 13.
12. Mills, ref. 10, p. 18.
13. Mills, ref. 10, p. 29.

Why Wright is wrong on creation

Surprised by Scripture: Engaging with Contemporary Issues

N.T. Wright

SPCK, London 2014*

Andrew Sibley

The well-known New Testament scholar and former Anglican bishop N.T. ('Tom') Wright has written several chapters in his recent book, *Surprised by Scripture*, that comment on creationism and a Christian approach to Adam and Eve.

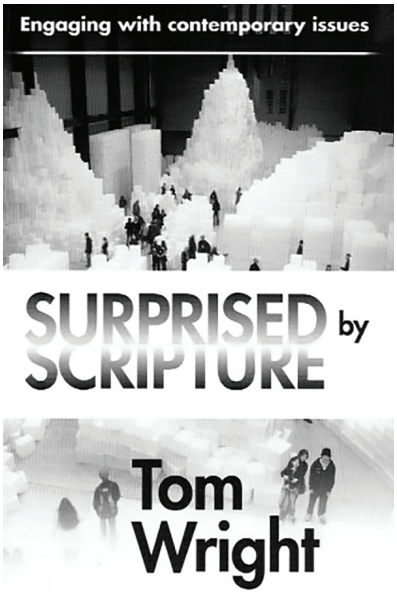
Wright has made some notable contributions to evangelical theology in the past, especially on Christ's Resurrection.[1] Wright has also emphasized the Gospel in relation to the heralding of the kingdom of God, the need to see unity between God's plans in the Old and New Testaments, and a rejection of a neo-Gnostic eschatology that seeks heavenly glory with little concern for the earth. However, his 'New Perspectives on Paul' has been justifiably criticized for its faulty view on biblical justification.[2] But in this recent book Wright fails to follow through in his thinking on the influence of neo-Gnosticism on Christian thought regarding creation, and there are some inconsistencies here and loose ends that need to be considered.

In this book Wright is critical of fundamentalism, but fails to explain adequately what he means by this term. Historically the term was used for the followers of the 12-volume series entitled *The Fundamentals: A Testimony to the Truth* (1910–1915). These defended five fundamental doctrines of the Christian faith:

- the inerrancy of the Bible
- the virgin birth of Christ
- the substitutionary atonement of Christ
- the bodily resurrection of Christ
- the authenticity of Christ's miracles.[3]

Some liberals use the term 'fundamentalist' pejoratively against opponents as a means of ignoring their concerns and thus avoiding an accurate response, but Wright is really closer to the mainstream evangelical movement than to the liberal wing. Now it is true that Christians can lose sight of God's love and grace-filled purpose in the world, and thus fall back on narrow-minded legalism. That is something we all need to guard against, and if that is what he means by fundamentalism then it is something we need to be careful of.

Although the book looks at a number of contemporary issues, it is the first few chapters that are the main focus of this review, even though some of the other chapters pick up on similar themes regarding Epicurean influence on modern life (figure 1). The first chapter looks at science and religion: 'Healing the divide between Science and Religion'; the third chapter is 'Can a Scientist believe in the Resurrection?' Other chapters are of less direct relevance to creation, but are of interest. They concern, for instance, the role of women in leadership, environmentalism, suffering, politics, and the end times. The second chapter, entitled 'Do we need a historical Adam?', is of most interest to creationists. He seems to follow Dennis Alexander[4] and John Walton[5] in holding to Adam and Eve as federal heads to humanity, two individuals called out from among other hominids to be God's representatives and co-workers on Earth.



Is the young-earth position allowable?

In the second chapter, 'Do we need a historical Adam?', he makes quite critical remarks towards young-earth creationism, suggesting it is a false position and not even 'allowable' theology.

> "I wonder whether we are right even to treat the young-earth position as a kind of allowable if regrettable alternative, something we know our cousins down the road get up to but which shouldn't stop us getting together at Christmas … . And if, as I suspect, many of us don't think of young-earthism as an allowable alternative, is this simply for the pragmatic reason that it makes it hard for us to be Christians because the wider world looks at those folks and thinks we must be like that too? Or is it—as I suggest it ought to be—because we have glimpsed a positive point that urgently needs to be made and that the young-earth literalism is simply screening out? That's the danger

*US Version: *Surprised by Scripture: Engaging Contemporary Issues*, HarperCollins, New York.

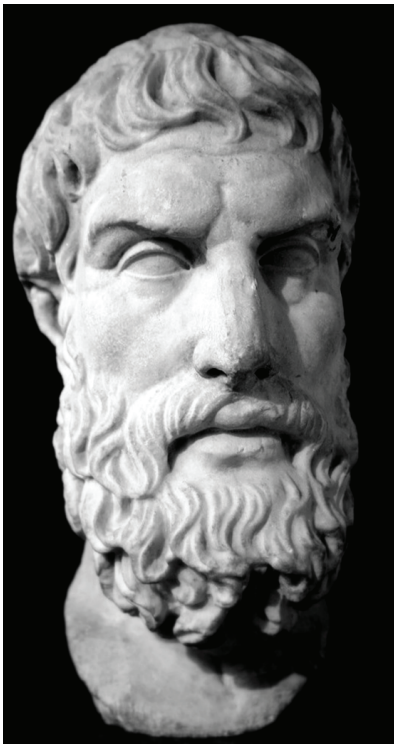


Figure 1. Bust of Epicurus, housed in the British Museum, London. It is a Roman copy, in Marble, of a Greek original. Wright recognizes the negative influence of Epicurean philosophy upon evolutionism and modern thought, but still fails to see that this philosophy is foundational to the 'science' of evolution.

> of false teaching: it isn't just that you're making a mess; you are using that mess to cover up something that ought to be brought urgently to light" (p. 31).

He thinks that evangelical Christians should therefore reject it and proponents may not even be worthy of being properly accepted in the family of the evangelical community until they turn from their foolish ways. For Wright they must be confronted firmly, even if gently and with civility, perhaps in the same way that Paul challenged Peter at Antioch for the sake of truth. However, this would logically mean that we should reject all the Church Fathers (including Augustine), medieval theologians, and Reformers, who affirmed what we would now call 'young-earth creation', and most of whom accepted creation in six 24-hour days.[6]

Wright rightly criticizes evolutionism

Wright is also critical of evolution with a big 'E', and correctly notes that it is not a new idea as it arose from Greek Epicurean philosophy. In the first chapter, and in later chapters, he rightly identifies this philosophy as a problem in modern thought, which he thinks underpins the whole of the Enlightenment project. This influence leads to the removal of a sense of divine judgement and a move towards hedonism, and to the ancient philosophy of evolutionism. He does acknowledge that some forms of theistic evolution go too far in embracing naturalism, and even acknowledges that he might be seen as an opponent of the Enlightenment and modernism. He doesn't wholly dismiss this claim and recognizes good and bad in it. However, he thinks Christians should be willing to accept the broader theory of evolution in theistic terms because it is a 'proven hypothesis' (p. 32).

Creationists are seen as both anti-science and too scientific

He seems to fail to understand the position of creationists, and also fails to see how deeply Epicurean philosophy has shaped the claims of Darwinists. Creationists generally draw a distinction between operational and historical science, those things that are directly demonstrable, such as minor variation in the breed of dogs, cats, and livestock, and those claims that arise out of some other source. Augustine saw the same distinction and was willing to accept operational science, but not claims that come from pagan sources.[7] Creationists have also accepted limited forms of natural selection and adaptation—from before Darwin to the present—but within the context of created kinds; and as far as science goes such limited adaptation is 'proven'. But when Darwinists speak of an evolutionary progression of early man from other apelike ancestors they are moving to conjecture and opinion that is more in harmony with Greek paganism.

Wright is also critical of the creationist response to Epicurean thinking, suggesting that opposition to Darwinism is still framed in what he calls the modernist neo-Gnostic division between the natural and supernatural.[8] Creationists then are at the same time seen as both anti-science and too wedded to a modernist, scientific mindset. There may be some merit in the latter claim, even as the anti-science claim is false. Creationists generally value science, as even the lapsed Adventist historian Ron Numbers has pointed out that, "creationists rarely display hostility towards science".[9] And I think many creationists recognize the second problem regarding scientific modernism, even if the language is not always framed in the right terms.

However, in seeking to establish a bridge between naturalism and supernaturalism, Wright doesn't really elaborate on what he means, which is a shame. He could, for instance, follow Thomas Torrance in seeing that Einstein's General Relativity breaks down the dualism between the fixed form of the universe and the human observer. This dualism follows from the Newtonian–Kantian container-box model of the universe, which effectively excludes God from creation.[10] And it is noteworthy that many creation scientists do seek to understand the age of the universe through the lens of relativity. Wright fails to get to grips with the detail of creationist thinking; he admits that he dropped out of science at an early age to study classics. He does however rely upon close friendships with leading scientists such as Francis Collins, who is specifically mentioned in the Preface as an influence upon him. However, Collins, like many theistic evolutionists, seems bound-up in accepting evolutionism,

something criticized by Wright as a faulty approach to the theology and science relationship.[11] Collins also seems to deny an historical Adam.[12]

How did the Apostles and Church Fathers read Genesis?

For Wright, Genesis is read as primarily a literary, poetic work and he thinks this is how Paul, John, and Peter read it, and not in the context of literal 24-hour days and a recent creation. But this needs some justification on his part, which he doesn't give in this book. A plain-sense reading of the New Testament would suggest that they *did* hold to a literal six-day recent creation. The Gospel writers also saw symbolism in the real miracles of Jesus—the symbolism arising out of real, literal events, or the literary arising out of the literal. And this is how they read the Old Testament, where real events speak symbolically of Jesus and his redemptive work. This is similar to the rabbinical *peshat-pesher* approach to biblical interpretation (holding both literal and symbolic meaning), except that for the Gospel writers it is focused upon Jesus. And we ought to ask why a similar hermeneutic would not apply to their reading of Genesis.

It was seemingly the writings of John and Peter that led some of the Church Fathers to infer a millennial scheme where the seven days of creation prefigured seven thousand years of history, the final day of rest corresponding to a millennial rest with Christ reigning on Earth.[13] Paul also speaks of the physical "first man, Adam" pointing to the spiritual "last Adam", Jesus (1 Corinthians 15: 42–49)—the literal, or natural, pointing to the spiritual. The bottom line for Wright is that while he seeks to get rid of neo-Gnostic thinking with regard to the Resurrection and eschatology, he doesn't seem to follow through in his reading of Genesis and the creation account. His reading of Genesis is still seemingly influenced by neo-Gnostic approaches to biblical interpretation.

Paul may of course have been aware of Philo's writing on the creation. Although Philo saw the days of creation as allegorical, because of a reading of the LXX Apocrypha and the influence of Plato, there is no reason to think that Philo did not hold to a young earth.[14] He thought that creation had occurred all at once, but Paul was not bound to follow Philo in this regard. Some early theologians, such as Origen, were also influenced by Philo and neo-Platonism; that is, the desire to read Scripture in an excessively spiritual, allegorical context. Yet even Origen firmly rejected long ages.[15]

But others read the symbolic from the literal. St Basil recognized the laws of allegory, but read the creation account literally as well, claiming to be not ashamed of the Gospel.[16] Augustine also held to a young earth in a literal sense even as he was seemingly following Philo in believing that creation occurred all at once. He was however critical of claims about the age of the Earth that arose from pagan sources:

> "They are deceived, too, by those highly mendacious documents, which profess to give the history of many thousand years, though, reckoning by the sacred writings, we find that not 6,000 years have yet passed."[17]

So, whereas Wright doesn't think young earth creationism is an allowable position, clearly many of the Church Fathers did, and a common sense reading of Scripture suggests that is how the New Testament writers read Genesis. Wright really needs to justify his comments in light of the position of the Apostles and early Christian theologians.

Wright has, of course, produced a lot of material on the Greek and Hebrew background to Paul's life, although he doesn't directly reference it in this book. He does, though, seek to read Paul in the context of Second Temple Judaism. However, as Duncan has shown, there are good reasons to think that Sanders, Dunn's and Stendahl's analysis, which has influenced Wright in this regard, is faulty.[18] There is, I think, difficulty in attributing the background of Hebrew Rabbinical thought to Paul's post-conversion life. Paul was, of course, trained in both the school of the Pharisees and in Greek philosophy, as well as in Greco-Roman rhetoric, but he received revelation of the power, richness, and wonder of God that led him to preach the Gospel. He had a keen sense of the power [Greek *dunamis*] of God at work in his life and that of the church. And when we study the New Testament letters of Paul we are led back, time and again, into the Old Testament prophets. I can't help thinking that Paul saw his calling in the same light as an Isaiah or Elijah, perhaps someone who felt like an outsider to his own people, even as he was calling them to Christ. And Wright has previously noted the correlation between Paul's conversion on the road to Damascus and Elijah's journey.[19]

Creationism is not grounded in dispensationalism

Wright also fails to engage in the depth and breadth of thought among creationists, but instead makes wide-ranging and erroneous generalizations. For instance, he conflates young-earth creationism with dispensationalism, thinking that a literal reading of Genesis goes hand-in-hand with nineteenth-century Darbyite theology. John Nelson Darby's theology was focused upon a developing Christian Zionism, a secret escapist rapture, and the end times. Most obviously, Wright ignores the prevalence of literal readings long before Darby. Also, it is clear that Darby's followers were not that bothered about a literal reading of Genesis. The text notes

of the *Scofield Reference Bible*, for instance, a widely read publication from the early twentieth century that promoted Darby's theology, discusses pre-Adamic races and the gap theory. These ideas were all rejected by young-earth creationists. Rather, when John Whitcomb and Henry Morris wrote *The Genesis Flood* (1961), often credited with reviving young-earth creation, the book was accepted by the clearly non-dispensational Presbyterian and Reformed Publishing.

The early Fundamentalists such as B.B. Warfield (who contributed a chapter, "The Deity of Christ", to *The Fundamentals*) and James Orr ("Science and Christian Faith") were not especially committed to a young earth either. Today you will find that young-earth creationists have varying views on dispensationalism and Darby's theology; some may be sympathetic, others will hold more to Covenant Theology.

I would suggest that it is more likely that the reawakening of belief in a literal creation stems from popular-level revivalism, for instance as found in the writing of John Wesley (1703–1791) and his down-to-earth preaching to the man-in-the-street. Pentecostal and Charismatic revivals have also encouraged belief in the possibility of miracles, thus building faith in God's ability to act in the world. Pentecostalism has often been most accepted among the ordinary folk and working classes. In this movement there is a rejection of cessationist views regarding miracles among ordinary people, and this, I would suggest, correlates with belief in a literal creation and rejection of naturalism among Christians.[20] Tenneson and Badger report that at least from the 1920s onwards the young-earth position was the 'prevailing view' among Pentecostals, and, from recent survey evidence, suggest it is still the largest position (35%).[21] It was eighteenth and nineteenth century writers, such as David Hume and Charles Darwin, who promoted naturalism and were so skeptical of miracles, while liberal academic theologians were naturalizing Christian faith. The rise of acceptance of a literal reading of Genesis then correlates with Christian revivalism and a rejection of materialism and naturalism. If one believes that God may act in the world today or in the time of Jesus, for instance through the Resurrection, as *The Fundamentals* required, then why not believe that God acted in a miraculous way in the creation account, speaking all things into existence through his powerful word?

Concerns about anti-intellectualism

Wright raises concerns about anti-intellectualism in fundamentalist Christian circles, suggesting an opposition to study and science among creationists. But this is far from the truth as many creation scientists have multiple and higher degrees in a wide range of subjects. There is, however, a problem in the Western secular education system for the children of conservative Christians. It is that they are taught one set of beliefs at home and at church, and then another at school, and this leads to confusion. Some make it through, understanding the worldview struggle that exists, but others keen to be faithful to Christ give up on academic study, while others sadly lose their faith. There is no reason, however, why a consistent conservative Christian view of the world cannot be intellectually rigorous and demanding, as Augustine's writing, for instance, shows. It is just that it is not given an opportunity to flourish when secular humanism dominates and directs education for Christian children. Wright really needs to examine and address this problem instead of blaming it on Christian fundamentalism.

The needs of the academy versus the needs of the market square

This raises further issues regarding the needs of the academy versus the needs of the market square, or man or woman in the street. Wright seems concerned about the effect that creationism has upon respect in academic circles, as do others such as Denis Alexander. The purpose of holding to evolution, then, is to make the Gospel acceptable to non-Christian academics through the appearance of human respectability. Ordinary people, however, have a simpler view of truth, which leads them to read Scripture literally. However, we need to heed Paul's message in 1 Corinthians 1. He tells us that unity is of prior importance for the sake of Christ, the community of believers, and the Gospel. And further, that the Gospel message is foolishness to the wisdom of the world. From this Paul tells us that God uses the foolish things of the world to shame the wise. Human respectability only leads to pride, which is a stumbling block to the Gospel.

While Wright is right to tell us of the Epicurean perspective on modern life, it is evident that the academy is a place of elitism, and this correlates with the thinking of Plato regarding the place of academics in society. Plato's idea was that philosopher-kings should rule the ideal city-state, while the majority should only be educated to such a level that they are economically productive.[22] As a result Greek society was elitist, but Paul insists that within the Christian community there is equality (Gal. 3:28). Christian academics in secular universities, however, can then find themselves caught up in a world that is elitist with an overwhelming peer pressure to conform to the worldly view with its ancient Greek influence. Within the Platonic scheme symbolic, spiritual readings of religious texts have greater value than literal readings. However, we see from

the New Testament authors, and Church Fathers, that the symbolic readings arise from real, or literal, events. We need to accept, then, that the Gospel that we hold to may appear foolish to those steeped in Greek thinking, and we should not be ashamed of the message. The Gospel needs to be preached in humility, and if that means bearing the shame of foolishness because we read Genesis literally or sharing the shame that Christ endured upon the Cross, then so be it (Heb. 13:12–14, Rom. 1:16).

Summary

There are some useful chapters in this book, and many have appreciated Tom Wright's insights on a number of issues. It is, however, regrettable that he doesn't follow through when he approaches interpretations of Genesis and the creation account. But at least he does acknowledge the Epicurean influence upon evolution, even if he doesn't go far enough for creationists. We need a dialogue based upon integrity and honesty, and a more careful reading of the New Testament authors and Church Fathers. Simply seeking to dictate to creationists what is and what is not allowed is insufficient. There is a need for academics to be brave enough to engage more deeply with popular-level theology. There are a number of historical incidents where the theological academies have had to play catch-up as ordinary people pick up on fresh insights of God's dealing with the world. Martin Luther had to leave his academic position, and posted his Ninety-five Theses to the outside of the church door at Wittenberg. John Wesley was prevented from preaching in the Anglican churches so took the revivalist message of Jesus around the country, often preaching in the market square. The Pentecostals and Charismatics also experienced the reality of revival and taught about the baptism of the Holy Spirit. Today young-earth creationism is growing outside of academic circles as people rediscover God's power in creation—and perhaps this is another area where academic theologians need to catch up with what God is doing in the church. But we should not forget that we also need academic theologians to scrutinize popular-level theology because it sometimes makes mistakes. But regrettably the theological academies are sometimes out of touch with the needs and aspirations of ordinary people.

References

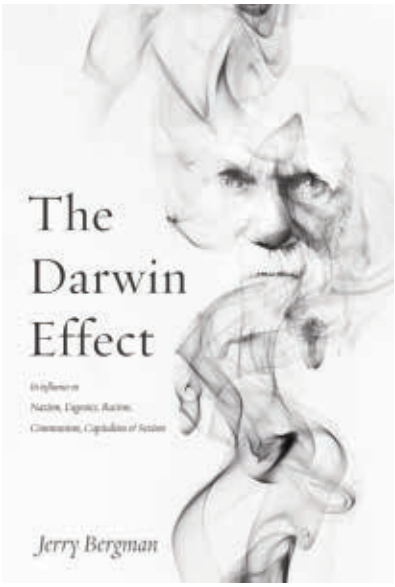
1. Wright, N.T., *The Resurrection of the Son of God*, Christian Origins and the Question of God, vol. 3, Fortress Press, Minneapolis, MN, 2003, and *Surprised by Hope*, SPCK, London, 2011.
2. Duncan, J.L., The Attractions of the New Perspective(s) on Paul, alliancenet.org, 2009; accessed 26 September 2014.
3. Grigg, R., Anyone for fundamentalism? *Creation* **30**(4):15–17, 2008; creation.com/fundamentalism.
4. Anderson, D., Creation or evolution: choose wisely! A review of *Creation or Evolution—Do We Have to Choose?* by Denis Alexander (2008), *J. Creation* **23**(2):41–45, 2009; creation.com/alexander-review.
5. Statham, D., Dubious and dangerous exposition, A review of *The Lost World of Genesis One: Ancient Cosmology and the Origins Debate,* by John H. Walton (2009), *J. Creation* **24**(3):24–26, 2010; creation.com/genlostworld.
6. Lewis, J.P., The Days of Creation: An Historical Survey, *J. Evangelical Theological Soc*. **32:**449, 1989.
7. Augustine, *The Literal Meaning of Genesis (de Genesi ad Litteram)*, translated and annotated by John Hammond Taylor, vol. 1., Paulist Press, S.J., New York, book I, chap. 21, p. 41, 1982. "When they are able, from reliable evidence, to prove some fact of physical science, we shall show that it is not contrary to our Scripture. But when they produce from any of their books a theory contrary to Scripture, and therefore contrary to the Catholic [universal] faith, either we shall have some ability to demonstrate that it is absolutely false, or at least we ourselves will hold it so without any shadow of a doubt."
8. Although many Christians, C.S. Lewis included, see a useful distinction here to describe the difference between God's ordinary activity in the world, and his extraordinary activity.
9. An interview with Ron Numbers on PBS. He comments, "To me, the struggle in the late 20th Century between creationists and evolutionists does not represent another battle between science and religion because rarely do creationists display hostility towards science. If you read their literature, you'll rarely come across an anti-scientific notion. They love science. They love what science can do. They hate the fact that science has been hijacked by agnostics and atheists to offer such speculative theories as organic evolution." www.pbs.org/faithandreason/transcript/num-frame.html.
10. Torrance, T.F., *Christian Theology and Scientific Culture*, Christian Journals Limited, Belfast, 1980. Of course Newton was not seeking to try and remove God from the universe, but that is where an increasingly mechanistic and less personal model was leading, through, for instance, Kant's thinking.
11. See, for instance; Weinberger, L., Harmony and discord: A review of *The Language of God: A Scientist Presents Evidence for Belief*, by Francis S. Collins (2006), *J. Creation* **21**(1):33–37, 2007; creation.com/collins-review.
12. Carter, R.W., The Non-Mythical Adam and Eve! Refuting errors by Francis Collins and BioLogos, creation/biologos-adam, 20 August 2011.
13. See, for instance, Sibley, A., Creationism and millennialism among the Church Fathers, *J. Creation* **26**(3):95–100, 2012.
14. Zuiddam, B., Does Genesis allow any scientific theory of origin?—a response to J.P. Dickson, *J. Creation* **26**(1):106–115, 2012; creation.com/dickson.
15. "After these statements, Celsus, from a secret desire to cast discredit upon the Mosaic account of the creation, which teaches that the world is not yet ten thousand years old, but very much under that, while concealing his wish, intimates his agreement with those who hold that the world is uncreated." Origen, *Contra Celsum* (*Against Celsus*) 1.19, Coxe, A.C., *Ante-Nicene Fathers: The Writings of the Fathers Down to A.D.325* **4:**404; www.biblehub.com.
16. "I know the laws of allegory, though less by myself than from the works of others. There are those truly, who do not admit the common sense of the Scriptures, for whom water is not water, but some other nature, who see in a plant, in a fish, what their fancy wishes, who change the nature of reptiles and of wild beasts to suit their allegories, like the interpreters of dreams who explain visions in sleep to [m]ake them serve their own ends. For me grass is grass; plant, fish, wild beast, domestic animal, I take all in the literal sense. 'For I am not ashamed of the gospel'." Basil, *Hexaëmeron*, Homily 9:1;IN: Schaff, P. (Ed.), *Nicene and Post Nicene Fathers*, Series I and II, 1886–1890; ccel.org.
17. Augustine, *The City of God* **12**(10), "Of the falseness of the history which allots many thousand years to the world's past." (in Schaff's Volumes).
18. Duncan, J.L., The Attractions of the New Perspective(s) on Paul, alliancenet.org, 2009; accessed 26 September 2014.
19. Wright, N.T., Paul, Arabia, and Elijah (Galatians 1:17), *J. Biblical Literature* **115**:683–692, 1996.
20. See, for instance, Ruthven, J., *On the Cessation of the Charismata*, Word and Spirit Press, Tulsa, OK, 2011. (Ruthven describes the influence of Hume's rejection of miracles on cessationist thought). It is noted that CMI does not take an official position on debates over Covenant Theology vs Dispensationalism, nor on Cessationism vs Pentecostalism. And there are many cessationists who hold to a recent creation.
21. Tenneson, M. and Badger, S., A Brief Overview of Pentecostal views on Origins, *Enrichment Journal*, Assemblies of God, Spring 2010; enrichmentjournal.ag.org/201002/ejonline_201002_origins.cfm, accessed 30 September 2014. They report that 31% would now be described as old-earth creationists, and only 16% theistic evolutionists.
22. Plato, *The Republic* (Greek: Πολιτεία, Politeia), 380 BC (5.473D).

Darwinism has remade Western society—for the worse

The Darwin Effect: Its Influence on Nazism, Eugenics, Racism, Communism, Capitalism, and Sexism

Jerry Bergman

Master Books, Green Forest, AR, 2014



John Woodmorappe

This work covers the effects of the Darwinian revolution on 19th and 20th century thinking. It is striking how pervasive and harmful this effect has been. Because this work is so rich in diverse topics, I focus on only some of them and concentrate on developments in the latter part of the 20th century.

Darwin was not simply a product of his time and culture. To the contrary, he effectively steered his culture. His ideas were aggressively promoted and they transformed societies. Moreover, the interactions of Darwinism with so many different strands of human thought were, and are, much too pervasive to be dismissed as 'misunderstandings' or 'misinterpretations' of Darwinism.

Bergman also makes it obvious that so-called scientific Darwinism and Social Darwinism cannot be dichotomized. The latter flows seamlessly and effortlessly from the former. In fact, 'Social Darwinism' was freely practised, not just by extremists but by mainstream biologists. Nor was it some kind of passing 19th century fad. Bergman comments: "The racist views of early Darwinists were widely supported, not just by a few renegade scientists, but by most of the leading biologists until at least the 1950's" (p. 61).

Finally, the matters raised are not solely of historical interest. There are, for instance, modern forms of racism, sexism, eugenics, etc., that exist even today and I discuss some of them.

Of course, the author is not claiming that Darwinism was the sole source of ideas such as racism. However, racism became prominent, as never before, because Darwinism gave racism the imprimatur and prestige of scientific support and because racism followed logically from the 'survival of the fittest' dictum of evolutionism.

Author Bergman has a sense of humour. He compares those who say that Darwin was a nice, ethical man (not to be held responsible for the implications of his theories) with the fictional Dr Frankenstein, who stated that he was not responsible for the killing spree done by the monster he had created. Touché!

Racism fuelled, not merely reflected, by Darwinism

Evolutionary ideas, of course, did not begin with Darwin. The late 18th century enlightenment, for example, had a proto-evolutionary, anti-Christian strand (as exemplified by Voltaire) that rejected monogenism (all humans descended from Adam and Eve) in favour of polygenism (multiple origins of human races). This was an anti-Christian weapon (p. 64). As for Darwinism, his ideas were widely accepted long before the publication of *The Origin of Species* in 1859.

It is not correct to say that Darwinism merely 'joined' the racism that had already existed. Leading Harvard evolutionist Stephen Jay Gould pointed out "biological arguments for racism may have been common before 1859, but they increased by orders of magnitude following the acceptance of evolutionary theory" (p. 135). Nor was this limited to abstract, academic theories. Darwinism created an explosion of practical racism that had not existed before. Bergman writes: "It was primarily between 1870 and 1900 that educated Americans moved toward a wide acceptance of varying forms of eugenic-based racism" (p. 56).

The long-term racist impact of Darwinism on public policy cannot be overstated. Bergman comments:

> "Major Leonard Darwin, Charles's son, was president of the British Eugenics Society from 1911 to 1928. The impact of the eugenics movement on American law was especially profound. In the 1920s, Congress passed numerous laws intended to restrict the influx of 'inferior races', including those from southern and eastern Europe, as well as China. Eugenic beliefs were also reflected in everything from school textbooks to social policy. American Blacks especially faced the brunt of these laws… . Interracial marriages

were forbidden by law in most states, and discouraged by social pressure in all states" (p. 55).

Darwinian racism in action

The Darwinism-based racism of the 19th century had many different manifestations. White explorers saw non-white natives as self-evidently inferior in an evolutionary sense (figure 1). Western imperialism seemed to follow naturally from the struggle for existence, and the dominance of more evolved races over less evolved races seemed to be self-evidently justified by nature. That blacks should serve as slaves of whites seemed common sense. Pygmies were brought in to Western countries, and displaced in circuses and freak shows, as examples of 'missing links' or evolutionary atavisms. They helped convince the general public to believe in evolution.

The American Civil War largely centered on racism and slavery. Afterwards, the KKK (Ku Klux Klan), a major American white racist organization, obtained intellectual support from Darwinism. Bergman shows how the KKK used the Darwinian theme of black 'savages'. Some KKK literature even rejected the biblical doctrine of creation in favour of a pre-Adamite theory which posited that blacks had originated from an earlier stock of half-beast ancestors. The British-Israelism creed taught that whites were the true 'chosen people', not Jews, and that this status excluded non-whites.

Such thinking exists today. David Duke, a former KKK member, raised Methodist, abandoned the monogenism of the Genesis account and embraced evolution. He was bowing to science and began using many of the same rationalizations as theistic evolutionists. This was because the differences between races were, to him, much too prominent to be ignored or downplayed. Ironically, David Duke bought into the now-discredited notion of 98% similarity, between chimps and humans, to argue that seemingly trivial differences in the human DNA of different races can result in profound and immutable differences between the human races.

Pointedly, Darwin-inspired racism is not just of historical interest. Nor is it limited to white people. Although Communism is supposed to be anti-racist, with racism being a tool of the capitalists to pit working-class peoples against each other, this did not prevent Chinese Communists from emphasizing racism with reference to the superiority of their own peoples. They did so within, of course, the context of Chinese culture.

Bergman does not mention that some modern African-Americans have turned Darwinian racism on its head. They have adopted Afrocentric thinking. This posits that blacks really had invented everything—including the Egyptian pyramids—and that the whites had merely copied and stolen their inventions. Some African-Americans also developed Darwinian racist constructs that have posited that whites are 'ice people'. Accordingly, the white race evolved during the ice age, and thereby exhibits negative characteristics such as lack of compassion, selfish individualism with acquisitive spirit, an absence of community, etc. In contrast, blacks are a more evolved 'sun people', having developed a strong sense of caring and community as a result of their evolutionary experiences.

Sexism

Darwinism added impetus to the notion that human females were inferior to males. This seemed self-evident. Males experience strong natural selection for the 'fittest'. This is manifested by men doing dangerous tasks, engaging in warfare, directly competing with each other for females, etc. This, of course, ignored the fact that most traits are not sex-linked, and so the same trait can be inherited by either the son or daughter of a union.

The foregoing is not only of historical interest. Sociobiology is a modern sub-discipline that has revived Darwinian-based biological

Photo: iStock/ Elenarts

Figure 1. One of many different forms of 'ape man' that seemed to follow from Darwinian concepts and which had obvious racist implications.

determinism as an explanation for many forms of human behaviour, notably that related to sex. In addition, some forms of modern feminism have argued, based on Darwinism, that it is actually the female that is the superior sex and that males have evolved to fulfil females' needs.

Some evolutionists today speak of Darwinism governing sexual behaviour in a manner that puts men and women into conflict according to their evolutionary needs. Thus, men tend to be promiscuous because their investment in their offspring is minimal and they are naturally selected to have as many offspring as possible. Females, on the other hand, are strongly invested in their young and so are naturally selected to find males who will take care of them and their offspring. In some cases, evolution has been used to justify rape as an evolutionarily legitimate strategy for creating more offspring and passing on one's genes to future generations.

Predatory capitalism

Bergman examines the effect of Darwinism in shaping the attitudes of the likes of American capitalist baron Andrew Carnegie (1835–1919). Carnegie embraced evolution and was an ardent disciple of Herbert Spencer (1820–1903), who coined the term 'survival of the fittest'. Thus he specifically related his conduct to the elimination of the less fit in favour of the more fit. He saw himself as an evolutionary success story, born in abject poverty to become one of the richest men in history. Fortunately, in later life, he broke with Spencerianism to become a leading philanthropist, giving away 90% of his wealth.

Although predatory capitalism, and Communism, at first seem to be opposites, they are not. Both see Christianity and its teachings as weak and outdated. Both are materialistic views of existence. Both are merely two sides of the same coin—the Darwinian struggle for existence as manifested by the class struggle.

From religious belief to Darwinism to atheistic Communism

The author delves into Communism. One striking feature of Bergman's work is the fact that most of the pioneering Communist leaders had been devout believers who got swept away by Darwinism and only then adopted Communism as a substitute religion. Bergman quotes James Pusey, who commented: "Marxism converted intellectuals—but [only] intellectuals who were already converted to Darwinism" (p. 278). The rest is history.

Let us elaborate on this. Karl Marx, of Jewish ethnicity, had been baptized a Lutheran and had written of his love for Christ. At university, however, he fell for atheism and materialism, and only then became a Communist. Friedrich Engels, raised in a pietistic religious family, also fell in love with Darwinism, calling it "absolutely splendid".

The same trend developed among emerging Russian revolutionaries. Alexander Herzen wrote of Darwinism in glowing terms. Vladimir Ulyanov (Lenin), raised by devout Bible-believing parents, became, in his words, fascinated with the ideas of Charles Darwin. Lev Davidovich Bronstein (Leon Trotsky) was converted from Orthodox Judaism to Communism through Darwinism. Joseph Dzhugashvili (Joseph Stalin) studied to be a priest before getting swept away by Darwinism and becoming a Communist.

The foregoing path, from religion to Darwinism to Communism, was also trod by revolutionaries outside of the Soviet Union. Mao Tse-tung (Mao Zedong), raised by a religiously devout (Buddhist) mother, became enamoured with Darwinism and then became a revolutionary. In fact, he came to see Darwinism as the foundation of Chinese scientific socialism, and strove to promote world Communism not only by revolution but also by war.

The murderous nature of Communism

Communism inflicted unspeakable suffering on humans. Mao Zedong's policies led to the murder of millions of Chinese, up to 30 million (or more). Mass murderer Pol Pot, the architect of the Cambodian genocide, had been inspired by both Mao Zedong and Charles Darwin. So was Vietnamese Communist leader Ho Chi Minh.

The total death toll from Communism assumes staggering proportions, as tabulated by Bergman (pp. 347–348). It amounts to at least several tens of millions of victims.

Conclusions

The reader may be astonished by the many manifestations of Darwinism in public policy. Clearly, this was a long-term intellectually established process.

Some evolutionists speak of Darwin and religion as being in separate magisteria. Compromising evangelicals, and many other Christians, never tire of saying that religion and evolution are completely compatible. Such a position reveals a complete misunderstanding of Darwinism and its fundamentally atheistic character, and is decisively contradicted by the historical developments discussed in this book.

Though not written this way, this work is a stinging rebuke to those who say that Darwinism is purely a scientific matter that can be placed in a watertight compartment apart from religion, politics, etc. Ideas do have consequences!

Why the West really is the best!

How the West Won: The Neglected Story of the Triumph of Modernity
Rodney Stark
ISI Books, Wilmington, DE, 2014

Andrew Kulikovsky

Rodney Stark, a sociologist and historian, is Distinguished Professor of Social Sciences at Baylor University. He has written many excellent books on religion and Christianity and its social impacts including *The Rise of Christianity*, *For the Glory of God*, *The Victory of Reason*, and *The Triumph of Christianity*. This new book builds on these works.

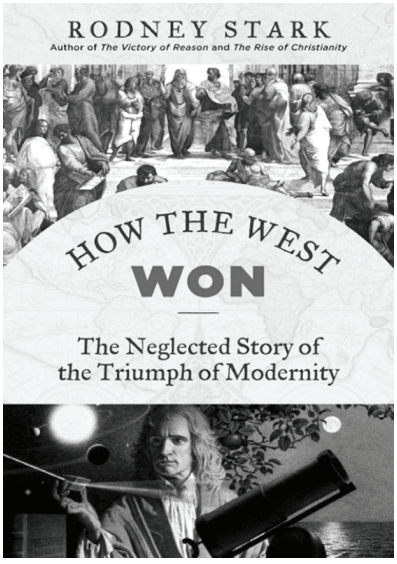
In *How the West Won*, Stark seeks to demonstrate three main points:

1. The development of Western civilization was overwhelmingly a positive force in world history. It is not only superior to all other civilizations in terms of power and influence but has actually delivered superior political, social, and economic benefits to the members of these societies.
2. Christianity and the church played a key role not only in the development of the Western intellectual tradition but also in events that led to important positive changes in the social, political and economic spheres.
3. Other civilizations had very little, if any, influence on Western civilization and modernity. The myriad of benefits of Western civilization are unique to it—in the sense that only Western civilization produced them. Even where other civilizations did make important scientific discoveries or technological innovations, they never exploited them in order to produce a social benefit.

Stark begins by noting that courses on Western civilization are now considered suspect and those who offer such courses are viewed as apologists for Western hegemony and oppression. Consequently, most American universities—including top Ivy League schools—no longer offer such courses. While this suppression and distortion remains, students "will become increasingly ignorant of how the modern world came to be" (p. 1). Even worse, students are "being badly misled by a flood of absurd, politically correct fabrications …" (p. 1). I suspect these consequences are by design and the intended goal of the censors.

Thus, Stark sets out to expose the many such myths and cases of revisionism in regard to the history of Western civilization, including:

1. Rather than a great tragedy, the fall of Rome was the single most beneficial event in the history of Western civilization.
2. The 'Dark Ages' never happened—this period saw remarkable progress and innovation in science, technology, architecture, art, literature, and music.
3. The Crusaders did not go in pursuit of land and loot. Their motives were religious and they went deeply into debt to finance their mission. They did not expect to return alive, and most did not.
4. Dramatic changes in climate played a major role in the rise of the West—the Medieval Warm Period was a time of bountiful crops and easy travel; the subsequent Little Ice Age produced crop failures, famines, and plagues.



5. Modern science did not suddenly appear in the 17th century but had roots that stretch back to the foundation of the first universities in the 12th century by the Scholastic natural philosophers.
6. Europe did not grow rich by plundering its colonies. In fact, colonies drained wealth from Europe while at the same time gaining the benefits of modernity.

Greeks and Romans

Stark begins his study by noting that the ancient Greeks were the first civilization to stand out and progress beyond all others. They developed core elements that triggered the emergence of Western society, including military superiority, democracy, economic progress, literacy, arts, technology, and philosophy. However, despite these great achievements, Greek civilization did not rise above the morality of other ancient societies. The economies of all the Greek city-states relied on extensive slavery. In fact, slaves often outnumbered the free citizens. The push to end slavery did not begin until the Catholic Church, in the medieval period, extended the sacraments to all

Figure 1: Belief in a rational God stimulated the pursuit of knowledge and led to the establishment of universities such as Sorbonne, part of the University of Paris and the world's second oldest university.

slaves and then banned the enslavement of all Christians and Jews.

Although the Greeks were among the first to systematically explore and develop various systems of democracy, they did not practise limited government committed to the rule of law and basic human rights. In most city-states, as in Athens, direct democracy was practised: important issues were decided by the votes of all male citizens. No class distinctions were involved and men in manual occupations enjoyed the same rights of citizenship as the wealthiest landowners. However, women and slaves were excluded. Moreover, it should be noted that "democracy merely gives power to the people; it does not ensure that power will be used wisely or humanely" (p. 19). "Athenians several times voted to slaughter all the men and enslave all the women and children of a conquered city-state. They also voted to convict Socrates of heresy and to impose the death sentence" (p. 19). Again, it was Christianity that ultimately provided the theological and moral basis for limited government to put a check on the abuse of power.

Although many historians regard the fall of Rome as a tragedy, Stark explains that the empire's fall was actually a beneficial rather than a negative event. The Roman era did not result in progress but was merely a pause in the rise of the West. Even the much-lauded Roman roads were actually bad for chariots and slippery for soldiers when wet, so they usually walked on the side of the road. Romans were like the Chinese, uninterested in developing their technology, and the fall of Rome did not give rise to a barbarian Europe but rather to Europe itself.

The not-so-Dark Ages

It is widely believed that the fall of Rome plunged Europe into the so-called Dark Ages of utter barbarism, when society declined and the great achievements of the ancient world were forgotten or neglected, until they were rescued and revived centuries later by the Enlightenment thinkers. As Bertrand Russell put it: "As the central authority of Rome decayed, the lands of the Western Empire began to sink into an era of barbarism during which Europe suffered a general cultural decline. The Dark Ages, as they are called."

Likewise, Charles Van Doren posited that the fall of Rome had "plunged Europe into a Dark Age that lasted for five hundred years". It was an age of "rapine and death" since "there was little law except that of force". Worse yet, "life had become hard, with most people dependent on what they could scratch with their hands from the earth around their homes". Van Doren went on to blame Christianity for prolonging the 'Dark Ages' because they disdained consumption and materialism while celebrating poverty and urging contentment. But as Stark points out, "serious historians have known for decades that these claims are a complete fraud" (p. xx). He adds that respectable encyclopaedias and dictionaries, such as *Columbia* and *Britannica*, now define the 'Dark Ages' as a myth.

Stark demonstrates that the truth is the complete opposite of the common belief: "Perhaps the most remarkable aspect of the Dark Ages myth is that it was imposed on what was actually 'one of the great innovative eras of mankind' … . During this period, technology was developed and put into use 'on a scale no civilization had previously known'" (p. 76). It was during this period that Europe made great technological and intellectual leaps forward, putting it well ahead of the rest of the world.

Freedom and political liberty

Most people living in the West today—especially those who were born there—generally take our various rights and liberties for granted. They know nothing else nor do they understand or appreciate the great and often violent struggles and wars in history that secured these rights. But, as Stark points out, a central key to Western success was the development

of political liberty. "If there is a single factor responsible for the rise of the West, it is freedom. Freedom to hope. Freedom to act. Freedom to invest. Freedom to enjoy the fruits of one's dreams as well as one's labour. So much of that freedom emerged during the so-called Dark Ages" (p. 139).

Christianity played a major role in this development because it "created a tendency for people not to be resigned to things as they are but rather to attempt to make the situation better" (p. 119). Christian theology also taught there was such a thing as absolute truth that could be rationally sought. These notions led to a rising opposition to slavery: "Belief in free will led directly to valuing the right of the individual to freely choose, with the result that medieval Europe rejected slavery—the only culture ever to have done so without external compulsion" (p. 119). By the end of the 8th century, both the Pope and Charlemagne opposed slavery.

Stark concludes:

> "A substantial degree of individual freedom is inseparable from Western modernity, and this is still lacking in much of the non-Western world. No doubt Western modernity has its limitations and discontents. Still, it is far better than the known alternatives—not only, or even primarily, because of its advanced technology but because of its fundamental commitment to freedom, reason, and human dignity" (p. 370).

Pursuit of knowledge and modern science

Belief in the rationality of God was another key element in the rise of the West. A rational God made the pursuit of knowledge possible. Thus, the church created the first universities (Bologna, Paris (figure 1), Oxford etc.) and paid for priests to take classes. The universities were staffed by the much-maligned Scholastics. But Stark posits that these men were fine scholars who "formulated and taught the experimental method, and launched Western science" (p. 159).

Stark argues that "The most fundamental key to the rise of Western civilization has been the dedication of so many of its most brilliant minds to the pursuit of knowledge. Not to illumination. Not to enlightenment. Not to wisdom. But to *knowledge*. And the basis for this commitment to knowledge was the Christian commitment to theology" (p. 159). He adds:

> "The pursuit of knowledge was inherent in theology, as efforts to more fully understand God were extended to include God's creation—thus inaugurating an academic enterprise known as natural philosophy, defined as the study of nature and of natural phenomena. During medieval times, a long line of brilliant Scholastic natural philosophers advanced Western knowledge in ways leading directly to the Copernican 'Revolution' and the extraordinary scientific achievements of the sixteenth and seventeenth centuries" (p. 160).

Indeed, Copernicus (figure 2) did not simply emerge from a miraculous virgin birth, gifted with divine insight in regard to his heliocentric theory. Copernicus had been trained by the Scholastics, and the Scholastics had, over the centuries, contributed much of the groundwork for the heliocentric model.

Stark goes on to demonstrate that it was Christians—or at least men who had religious convictions—who began the scientific revolution in the 16th and 17th centuries. Stark identifies 52 'scientific stars' from the period 1543 to 1680—famous scientists who were active in research, not just notable intellectuals such as Francis Bacon and Joseph Scaliger. Of the 52 scientists, only one (Edmond Halley), according to Stark, was an atheist and even this is doubtful.[1] All the others were either devout Christians or at least had strong religious convictions. Although the likes of Voltaire, Rousseau, Locke, Hume, and others have tried to take credit for the achievements of the 'Scientific Revolution,' none of these figures played any part in the development of the scientific enterprise.

Figure 2. Nicolas Copernicus was a devoted Christian who was trained by the Scholastics and used their many contributions over the centuries to construct his heliocentric theory.

Technological advances

Progress is not inevitable. Inventions do not just happen. Inventions need to be invented by someone and the likelihood that anyone will invent something is influenced by the extent to which they believe that inventions are possible. Moreover, inventions must not only be made but must also be sufficiently valued as to be used and widely adopted. This is not inevitable either. The Chinese rulers, for example, shut down iron production in the 11th century.

However, the "Christian conception of God as the rational creator of a comprehensible universe, who therefore expects that humans will become increasingly sophisticated and informed, continually prodded the West along the road to modernity" (p. 45). The notion that Christianity held back progress is completely false.

> "… advances in both science and technology occurred not in spite of Christianity but because of it. Contrary to conventional wisdom, science did not suddenly flourish once Europe cast aside religious 'superstitions' during the so-called Enlightenment. Science arose in the West—and only in the West—precisely because the Judeo-Christian conception of God encouraged and even demanded this pursuit" (p. 321).

In fact, the so-called Dark Ages saw radical technological progress largely because the stultifying hand of the Roman Empire was gone. The fall of Rome led to the emergence of new trade routes and towns that were devoted to commerce.

The evidence of technological progress during this time is overwhelming. In the 5th century, Germanic tribes developed a heavy plough with a blade that turned the soil over, whereas Rome never moved beyond the scratch plough. The harrow, which was used to break up soil clods, was developed shortly after. The shoulder harness for horses was also developed and farmers adopted the three-plot technique to prevent soil exhaustion. They also developed watermills and windmills and, unlike the Romans, employed them extensively. The Europeans also developed wagons with brakes and front axles that could swivel and to which horses could be harnessed, as well as new ships with better stability and greater cargo space.

The average person's standard of living also rose. With the fall of Rome, there was no more food subsidies or daily free distributions of bread, olive oil, and wine. However, Stark points out that studies based on isotopic analysis of skeletons have shown that people in the so-called Dark Ages ate very well, including plenty of meat, and as a result, grew taller and more robust than their predecessors in the Roman empire.

Yet, the most important developments during this period were in regard to military tactics and equipment. "Within several centuries of the fall of Rome, Europeans had developed military technology that far surpassed not only the Romans' but that of every other society on earth" (p. 84). Military power was extremely important in this era because Islam was on the rise and was now looking toward Europe. Muslim armies had already taken all of North Africa, which had once been solidly Christian. Superior military technology and tactics meant that Europeans were able to maintain a military presence for hundreds of years in the midst of Islamic territory, even though they were vastly outnumbered. Whenever Muslim armies came up against much smaller European armies they were almost always comprehensively routed despite outnumbering the Europeans many times over. The few Muslim victories on the battlefield were due to overwhelming numbers or as a result of sieges.

Figure 3. The Teotihuacanos, along with several other South and Central American civilisations, practiced human sacrifice at these pyramids. Human bodies discovered in excavations at the site indicate some men were decapitated, some had their hearts removed, others were killed by repeated strikes to the head, and some were buried alive.

Islamic societies and the Crusades

Stark also destroys many of the myths about Islamic societies and the Crusades. There is a common belief that early Islamic societies were enlightened and sophisticated and full of culture and, in many ways,

superior to Europe. However, Stark demonstrates that the so-called scientific knowledge and advances came primarily at the hands of Jewish and Christian dhimmies, or slaves, in Muslim-dominated lands. Islamic science and technology did not originate in Islamic culture but were always acquired or plundered from non-Islamic societies. 'Arabic' numerals were actually Hindu in origin. "'Muslim' or 'Arab' medicine was in fact Nestorian Christian medicine; even the leading Muslim and Arab physicians were trained at the enormous Nestorian medical center at Nisibus in Syria" (p. 297). Nestorian Christians were also primarily responsible for collecting manuscripts of the top Greek philosophers (e.g. Aristotle, Plato, Hippocrates, and Galen) and translating them into Arabic and Syriac. In fact, before the 9th century, virtually all the scholars living in Islamic societies were Nestorian Christians. Moreover, the Nestorians earned a reputation among Arabs for being highly skilled accountants, architects, astronomers, bankers, doctors, merchants, philosophers, scientists, scribes, and teachers.

Regarding the Crusades, he notes the common myth that most of the Crusaders set out in search of land and plundered loot. However, he points out that the truth is they "made enormous financial sacrifices to go—expenditures that they had no expectations of making back" (p. 103).

Although some Crusaders committed atrocities, these have often been exaggerated. Moreover, atrocities committed by Muslim forces have largely been ignored. For example, Baybars, Sultan of Egypt, had every Christian killed when Antioch fell in 1268, despite promising to spare their lives. This appears to be the greatest massacre of the entire crusading era! Saladin's mercy after the capture of Jerusalem appears to be exceptional. After the Battle of Hattin in 1187, Saladin had every knight beheaded.

New World colonialism

Stark continues his destruction and exposition of historical myths when discussing New World conquests and colonisation. He notes that

> "Nearly all modern accounts stress greed and racism as the basis for Europe's colonial expansion. Granted, both were significant factors, but so too were idealism and charity, especially on the part of Christian missionaries, who were often at least as concerned to educate and modernize foreign lands as to convert the world to Christ" (p. 357).

In fact, by the early 20th century, British and American overseas mission organizations had established 86 colleges and universities, 522 teachers colleges, and thousands of elementary schools in Asia and Africa.

Although colonialism allowed certain individuals and companies to earn great profits, these profits usually came at the expense of their fellow countrymen. Indeed, "European nations typically lost money on their colonial empires" (p. 358). As Stark points out, the American war for independence "was fought largely because the British Parliament, tired of losing money on the thirteen colonies, tried to impose taxes sufficient to cover the costs of administering and defending them" (p. 358).

In any case, many of the conquered ancient empires are not deserving of much sympathy, given that they engaged in cannibalism, mass sacrifice, slavery, and other atrocities. The ancient Aztecs (figure 3), for example, had 18 major ceremonies a year that required extensive human sacrifices, and they were conducted in over 80 different places! As Stark incisively points out:

> "To embrace the fundamental message of cultural imperialism requires that one be comfortable with such crimes against women as foot binding, female circumcision, the custom of Sati (which causes widows to be burned to death, tied to their husbands' funeral pyres), and the stoning to death of rape victims on the grounds of *their* adultery. It also requires one to agree that tyranny is every bit as desirable as democracy and that slavery should be tolerated if it is in accord with local customs. Similarly, one must classify high infant mortality rates, toothlessness in early adulthood and the castration of young boys as valid parts of local cultures, to be cherished along with illiteracy. For it was especially on these aspects of non-Western cultures that modernity was 'imposed' both by missionaries and by other colonialists" (p. 366).

In regard to the slave trade, Europeans did acquire many slaves and were responsible for extending the slave trade to the new world. However, they did not create the slave trade; they merely plugged into the pre-existing African slave market that had long been established by Muslims and African chieftains. Indeed, slavery was endemic to most, if not all, pre-colonial African societies. Yet, it was Europeans—prompted by both the Catholic Church and British evangelical Christians—who finally ended slavery in Europe and the African slave trade. No other civilization in history had done such a thing! Moreover, Britain employed its navy to ensure the slave trade ceased: "The earliest British military intrusions into Africa were devoted mainly to stamping out the slave trade. During 1840 alone the British navy intercepted 425 slave ships off the West African coast, hanged the slavers, returned the slaves to Sierra Leone, and set them free" (pp. 357–358).

Conclusion

Rodney Stark is a virtual 'voice in the wilderness' in challenging the politically correct dogma and presuppositions that dominate historical and sociological studies concerning Western civilization. It is clear that most of his fellow scholars have ceased to even bother examining the facts. A generation of students is now being indoctrinated with a false, distorted and negative view of Western history, and in the present age of multicultural ideology this lack of knowledge is very dangerous: why defend the institutions and values of a civilization that you believe has stolen, pillaged and exploited its way to prosperity at the expense of simple but noble, idyllic ancient societies? Stark's book should be required reading for all students. Not only does it serve as a corrective to common historical myths but it also documents the Christian foundations of Western civilization. This is critically important, because if the foundations are undermined or lost, the whole structure collapses.

Again, this book is a must read for all Christians and especially university students. It contains a wealth of information, is well-documented, and contains plenty of historical examples. Moreover, Stark is an excellent writer so the book is interesting and a joy to read. I highly recommend it.

References

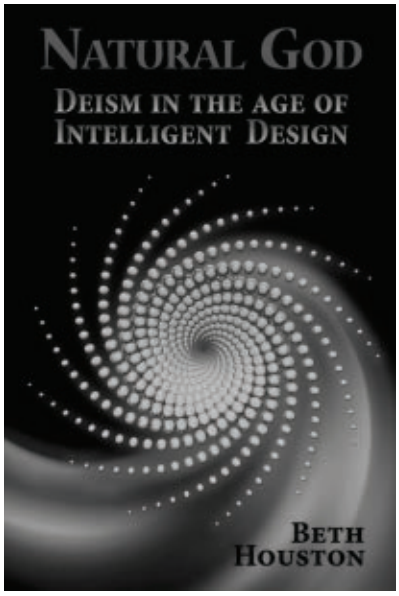
1. Halley proposed a bizarre hollow earth idea "trying to rebut allegations of atheism. When he lectured to the Fellows, he was applying for the Savilian chair of astronomy at Oxford, and rumours circulated about his orthodoxy: Halley was, alleged one of the electors, 'a skeptick and a banterer of religion'. Halley used his semi-hollow earth to support the Christian belief in a universe of finite duration by postulating an aether to slow down the planets. … Halley established his religious credentials still further by bringing God directly into his argument …", Fara, P., Edmond Halley's last portrait, *Notes and Records of the Royal Society* **60**(2):199–201, 22 May 2006 | doi: 10.1098/rsnr.2006.0143.

Non Christians recognize that the creation demands a creator

Natural God: Deism in the Age of Intelligent Design

Beth Houston

New Deism Press, 2012



Jerry Bergman

The author, a professor of creative writing and literature at the University of California and several other universities, covers a lot of material rarely reviewed in books critical of molecules-to-man evolution. One may wonder what a professor of creative writing and literature could contribute to the creation–evolution debate, and the answer is a fresh approach written in an engaging style that reflects a good understanding of psychology, logic, history, and biology.

Her work is one of many examples that have refuted the common claim that rejection of Darwinism is motivated primarily by theistic religion, not the problems with evolutionism. No friend of Christianity, Professor Houston includes a fair amount of criticism of the New Testament in her book. Her conclusion is that people do not need Scripture to learn about God. Reason, science, and observation are sufficient to realize that God exists, and that He created the world and all life in it. This position is called Deism, and is the same worldview that American President Thomas Jefferson held (figure 1). The focus of her work is not biology, although this area was covered in some detail, much of which is familiar to creationists and Intelligent Design supporters. Rather, her focus is on logic, history, and psychology. For this reason, this review will focus on several specific aspects of the book relating to Darwin's motivations.

She stresses that science, especially Darwinism, has now become a form of dogmatism that she feels should be challenged. One point documented is that Darwin's central ambition was not to explore the world to let it reveal itself, but to become famous (figure 2). She concludes that

> "… more than anything else, it was partly Darwin's focused ambition for respect that accounted for his success. It certainly explains his rush to publish the *Origin* … once Wallace arrived on the scene. It is also conceivable that the central role of survival-of-the-fittest competition in his theory of natural selection was a projection of his own ambitious nature. Though he doubted his intellectual agility, he considered his talent for observation and collection of facts to be

superior, and his love of natural science, 'steady and ardent'" (p. 126).

Houston writes that although Darwin enjoyed being a naturalist his motivation was, to quote Darwin himself, "much aided by the ambition to be esteemed by my fellow naturalists".[1] Early in his life, "Darwin was less than intellectually inclined. Ambitious as he was, his years at Cambridge were, in his words, a waste of time. … his academic interests were quite limited and his performance well below par" (p. 127).

While still a student at Cambridge, Darwin admitted that reading works by naturalists "stirred up in me a burning zeal to add … to the noble structure of Natural Science".[2] He once explained the reason he wanted to make a contribution to science was that he had a drive for fame.

The *Beagle* voyage

During Darwin's famous HMS *Beagle* voyage, his research was motivated by his drive to investigate, but also from his "strong desire to add a few facts to the great mass of facts in Natural Science … and [Darwin admitted] I was also ambitious to take a fair place among scientific men."[3] When he returned from his *Beagle* voyage, "Darwin was most strongly influenced by Sir Charles Lyell, a science mentor who 'was very kind-hearted, and thoroughly liberal in his religious beliefs, or rather disbeliefs'" (p. 127). Lyell's influence was important in helping Darwin achieve his goal of fame because "it was Lyell's encouragement, advice, and example that most ignited Darwin's aspiration to prove specifically a theory of origin––a topic very much in the air, and one that was sure to impress the impressive Lyell" (p. 127). Furthermore, Darwin knew full well that his one chance at making a major contribution to science

> "… would only be his theory of natural selection. Despite his own grave doubts, by the time the *Origin* was published and barked by his Bulldog [T.H. Huxley], Darwin was fully invested, if not in his theory's validity, then in the *need* for it to be valid and true, or at least highly esteemed. That need itself evolved" (p. 127).

In the end, Houston concluded that, in spite of Darwin's

> "… tendency toward self-depreciation, Darwin's ambition fueled his vanity and triggered defensiveness toward his 'original' theory of natural selection. Though his goal was to impress a few select people, he did relish the fame that came with success. Is ambition vain or humble if the writer cares not about the readers who made him famous? In Darwin's case, perhaps a bit of both" (p. 127).

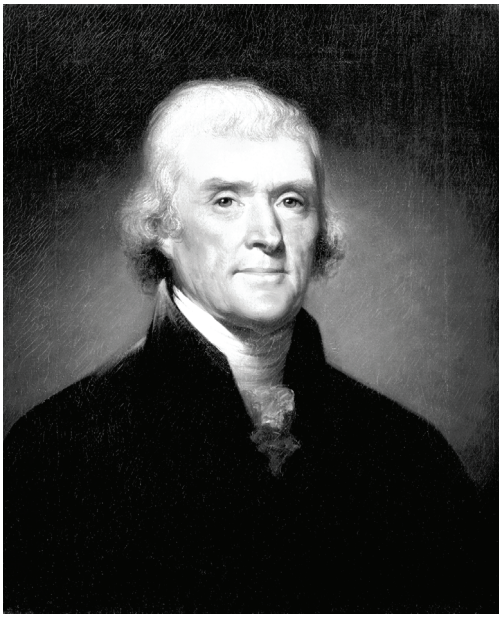


Figure 1. Jefferson is one of the most well-known American Deists. He believed in God based on the evidence of design in nature. Today Jefferson would be considered a supporter of Intelligent Design, yet he is exploited by secular humanists due to his authorship of the phrase "the wall of separation of church and state", which was part of a letter he wrote to the Danbury Baptist Church, written to assure them that the state would not interfere with the affairs of the churches then. In view of his own beliefs, he would hardly oppose the teaching of the evidence for creation in government schools today.

For example, Darwin wrote,

> "I think that I can say with truth that … though I cared in the highest degree for the approbation of such men as Lyell and Hooker, who were my friends, I did not care much about the general public."[4]

In contrast to this admission, Darwin once admitted that it was the *public success* of his first work, *The Voyage of the Beagle* (1845),[5] a book that covered his observations made on the volcanic islands that he visited during his *Beagle* voyage, which "always tickles my vanity more than that of any of my other books".[6] Houston concluded that

> "Vain or not, the fundamental force that drove his work was a desire for that high esteem among fellow naturalists that can only be attained by an important contribution to 'the noble structure of Natural Science'" (pp. 127–128).

Darwin's loss of his aesthetic sensibility

Houston has had a life-long interest in aesthetics, an interest that has determined the focus of her teaching career. She has carefully documented her position that evolution theory has caused its developer, Charles Darwin, to lose both his aesthetic sensibility and his appreciation of esthetic beauty. On what basis did she conclude this? First, she documented from Darwin's own words the fact that as he developed his evolutionary theory he lost his aesthetic sensibility, noting that as a young man, Darwin

> "… loved his dogs and his beetles, but he also loved killing and collecting trophies. Early on he believed in

> God and the Bible and even fervently defended his religion against the taunting crew of the *Beagle*; later his religion gave way to agnosticism which gradually slipped toward atheism. Darwin evolved—he grew up, he changed" (p. 162).

Houston added that Darwin changed in one other significant way. As he established his evolution theory "in spite of his fame and place beside the great scientists of the age, Darwin was aware that something profound and natural in him had been sacrificed: first and foremost, the faculty of aesthetic sensibility" (p. 162). To document this claim, she pointed to Darwin's love of art as a young man, which was clear evidence of his early aesthetic sensibility. She noted that, as a young man, "art brought him 'intense pleasure' and even sometimes 'excited' in him a 'sense of sublimity'". While a student at Cambridge,

> "… Darwin was, as he put it in his *Autobiography*, 'inoculated' by his friends and professors with a taste for quality art. He frequented the Fitzwilliam Gallery and the National Gallery in London, and the intense pleasure he got from the art of Sebastian del Piombo excited in him 'a sense of sublimity'" (p. 162).

Darwin also "acquired a taste for music from his musician schoolmates" in college (pp. 162–163). He "regularly listened to the daily anthems in King's College Chapel and even hired the chorister boys to sing in his rooms" (pp. 162–163). Later in life, he wrote in his autobiography that he admitted he was, when younger, "so utterly destitute of an ear, that I cannot perceive a discord, or keep time and hum a tune correctly; and it is a mystery how I could possibly have derived pleasure from music".[7] In response to this claim, Houston asks:

> "If Darwin's aesthetic faculty was so severely handicapped, what is the quality of pleasure he derived from flat, distorted sound … ? What is the quality of pleasure deprived of the depth and meaning of genuine appreciation? (p. 163).

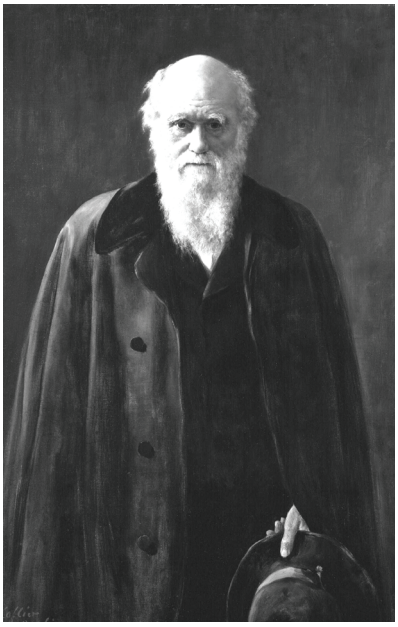


Figure 2. Charles Darwin in a photograph taken shortly before he died. More than any other man, he was responsible for the replacement of theistic creationism with evolution in Western society. Evolution has now become the secular creation story.

Houston also documented that Darwin's loss of his love for literature and poetry occurred later in life. When, as a young man on his five-year-long trip around the world on the *Beagle*, Darwin delighted in reading "the poetry of Wordsworth, Coleridge, and Milton, his favourite at that time and, most famously, the poet of *Paradise Lost*. But his love of metaphysics and poetry waned during his twenties" (p. 163).

She added that

> "Though he was informally taught to appreciate art and probably did derive pleasure from it … it's fair to ask whether by looking at art he was actually *seeing* and *appreciating* the work itself [emphasis in original]" (p. 163).

Even if Darwin's aesthetic sensibilities were not fully refined as a young man, all of the evidence we have shows that his pleasure in music and poetry that he claimed existed when he was young was genuine.

Darwin's loss of the aesthetic may be part of the reason, he rarely attended funerals.[8] In fact, "Darwin avoided funerals all his life unless it was absolutely impossible for him not to attend."[9] Darwin had a total of ten children, and three died while Charles was still alive (Anne, aged ten; Mary Eleanor, aged three weeks, and Charles Waring, aged one and a half).[10] He did not attend the funeral of his father, nor even his favourite daughter, Anne, who died of tuberculosis.[11] One funeral that he did attend was the 1 September 1881 funeral of his older brother Erasmus Alvey Darwin.[12]

Was Darwin's loss of aesthetic sensibility due to his evolution theory?

Houston concludes that it is no mere coincidence that, as Darwin developed his theory of evolution, his spiritual and aesthetic faculties both atrophied (pp. 163–164). Darwin's own assessment of the demise of his personal aesthetics is clear evidence of Houston's view. Darwin openly admitted that his appreciation for aesthetics had dynamically changed, at least in one major respect, during the last twenty or thirty years of his life, writing:

> "Up to the age of thirty … poetry … such as the works of Milton, Gray, Byron, Wordsworth, Coleridge, and Shelley, gave me great pleasure, and even as a schoolboy I took intense delight in Shakespeare, especially in the historical plays. I have also said that formerly pictures gave me considerable, and music very great delight. But now for many years I cannot endure to read a line of poetry: I have tried lately to read Shakespeare, and found it so intolerably dull that it nauseated me. I have also almost lost my taste for pictures or music."[13]

He also wrote in his autobiography that his "curious and lamentable loss of the higher aesthetic tastes is all the odder, as books on history, biographies,

and travels (independently of any scientific facts which they may contain), and essays on all sorts of subjects" still interested him, but, nonetheless, Darwin acknowledges that his mind had

> "… become a kind of machine for grinding general laws out of large collections of facts, but why this should have caused the atrophy of that part of the brain alone, on which the higher tastes depend, I cannot conceive … if I had to live my life again I would have made a rule to read some poetry and listen to some music at least once every week; for perhaps the parts of my brain now atrophied would thus have been kept active through use."[14]

Darwin then admitted that the

> "… loss of these tastes is a loss of happiness, and may possibly be injurious to the intellect, and more probably to the moral character, by enfeebling the emotional part of our nature".[15]

Houston concludes that it strikes her "as a peculiar tragedy worthy of Shakespeare or Milton" that Darwin,

> "… the man most responsible, nominally at least, for the sacrifice of the human spirit on the altar of mechanistic determinism could admit nonchalantly that he had in essence willfully programmed his mind into a machine—a computer—that resulted in loss of happiness, injury to moral character, emotional enfeeblement, and, ironically, severe mental atrophy. Darwin the man created the theory that symbolizes the absurd predicament, perhaps even the tragic flaw, of modern humanity" (pp. 165–166).

Evidence that evolution was partly responsible

The fact is, Darwinism became widely accepted in spite of its many major lethal scientific flaws and its open racism. And when Darwin was shown to be clearly wrong "he would always conclude that, all things considered, he was still right and everyone else was wrong".[16] Houston argued that

> "Darwin's faith in his theory of evolution reached the pitch of religious conviction even while he expressed his doubts about the theory's validity. The passionate naturalist, cannibalized by the dark lord kill-or-be-killed, leaned toward mechanistic atheism. … Darwin describes the objects and processes that his close observation once reckoned as beautiful, yet his stance now seems aloof and flat, as if his enjoyment of nature was like his tone-deaf 'enjoyment' of music or his atrophied pleasure in art and poetry" (p. 165).

She concluded that what was wrong with Darwin was that the "dimension that gives life lived to the fullest its zing" was gone or

> "… verged on extinction. By the time he finished the *Origin*, and certainly his later *Autobiography*, beauty had ceased to be beauty at all. Darwin objectified nature into a kind of intellectual pornography for scientific voyeurs; beauty was observed and used like a prostitute for a distant satisfaction of an immediate need, never for love of beauty for its own sake, never for the pleasure of intimate contact [with nature] [emphasis in original]" (p. 165).

Houston then applied this trend that occurred in Darwin to Darwin's followers:

> "Darwin, like some neo-Darwinians today, could state the facts of elegance and beauty in an objective, abstract tone even while the descriptions themselves betray the inherent vitality of their own inherent elegant beauty. … mechanistic agnostics like Darwin … know intellectually that nature is beautifully constructed while emotionally denying that it is. The aesthetic atrophies when the spirit does, or when the spirit lies dormant and inactivated. It is … mechanistic determinism and Darwinian natural selection. There is never any death of God, only the murder or suicide of the killer's own God-given faculties" (p. 165).

Darwin's spiritual disassociation

Houston concluded that, even though Darwin had major doubts about his theory, his faith in evolution was still strong enough to cause the atrophy of his aesthetic dimension:

> "Far from scientific treatises proving natural selection, Darwin's writings betray the psychological angst of a man plagued by self-doubt, contradiction, and denial. Read closely, his work becomes a casebook exposing the consequences of spiritual dissociation that has infected modern thought. The atrophy of the aesthetic faculty and its subsequent flattening of perception is a crucial symptom of spiritual dissociation rarely considered when assessing declarations of scientific theory as fact" (p. 166).

Furthermore,

> "Darwin realized that his mind had become a machine for grinding out abstractions from collections of facts, but because he had repressed his spiritual faculty and erased the possibility of spiritual dimension from Nature, he was unable to understand why his aesthetic faculty had atrophied …. What Darwin *knew about* he could not truly *know* [emphasis in original]" (p. 166).

Darwin wrote that he "had always been much struck by such adaptations" as the ability of "a woodpecker or a tree-frog to climb trees, or a seed for dispersal by hooks or plumes" but "until these could be explained it seemed to me almost useless to endeavor to prove by indirect evidence that species have been modified" via evolution (pp. 166–167). Darwin then

> "… spent the rest of his life trying to prove that species types have been modified into new types. He never succeeded. To an artist, transcending modifications are perfectly natural. Darwin was unable to process the *creation* in Creation. As any true artist knows, creation is a generous act of love [emphasis in original] (pp. 166–167).

Why evolution causes loss of aesthetic sensibility

As he developed his theory of evolution, Darwin concluded that he saw nature more and more both brutal and selfish. In one example, he wrote,

> "Natural selection cannot possibly produce any modification in any one species exclusively for the good of another species; though throughout nature one species incessantly takes advantage of, and profits by, the structure of another."[17]

In short, "Darwin considered life to be a battleground where opposites fight and separate themselves out, but Darwin's 'good' was brute selfishness, the antithesis of anyone else's definition of *good*" (p. 167). In Darwin's own words, "natural selection can, and does, often produce structures for the direct injury of other animals, as we see in the fang of the adder, and in the ovipositor of the ichneumon, by which its eggs are deposited in the living bodies of other insects".[18] Houston concluded, from her detailed study of Darwin's writing, that in

> "… Darwin's world of fangs and ovipositors, good equals harm successfully inflicted on another. In other words, benefit exists only through harm. … Darwin knew that his theory was dependent upon the inherent ruthlessness of Nature, not upon something reminiscent of the benevolent God of his abandoned religion" (p. 167).

For example, Darwin wrote if "it could be proved that any part of the structure of any one species had been formed for the exclusive good of another species, it would annihilate my theory, for such could not have been produced through natural selection".[19] Houston then speculates that

> "Darwin's insistence that natural selection is ultimately brutal is a projection of … the brutal side of his own nature. Natural selection justifies brutality and sanctifies guilt. The brutal cannot face a God who might not condone brutality. Therefore, religions create their gods in the image of their own brutality to justify and sanctify brutality, and science creates its god, natural selection, the shadow of civilized man, for the same purpose" (p. 168).

Furthermore, she concluded that the contrast of Darwinism and Creationism is critical in causing a loss of aesthetic value, writing that

> "… cooperative goodness produced by the God proclaimed by every major religion and recognized by the vast majority of people who have ever lived is an abstract construct to the tone-deaf, spiritually myopic Darwin. Intellectually, abstractly, Darwin understands the facts. … For Darwin, the glass is entirely empty. Life exists only to reproduce itself in an endless loop of brute survival for its own sake" (p. 168).

She generalized that the

> "Darwinians are like people who visit art museums but are never deeply moved by the art. For them, Nature is a picture of life, a still life produced with paints on a two-dimensional canvas. …What escapes them is depth, representational meaning, the correspondence between one world and another. … Reason is diluted by reductive scansion; intuition, emotion, and aesthetic exist like phantom limbs" (p. 168).

Summary

Professor Houston makes a convincing case that the natural world provides clear evidence for a creator. She also documents the adverse effects of Darwinism on society and persons, using, as a prime example, its destructive effect on aesthetics. Exhibit one was Darwin himself, who lost his early love of poetry, music, and his aesthetic sensibilities in general when he accepted an evolutionary origin for life. She then proposed a plausible explanation for this loss, namely his changed worldview, when he moved from a theistic creationist to an atheistic/agnostic evolutionist worldview. Last, she carefully documented her case in a convincing manner.

References

1. Barlow, F., *Charles Darwin*, *His Life*, D. Appleton, New York, p. 55, 1892.
2. Barlow, F., *The Autobiography of Charles Darwin 1809–1882*, Norton, New York, p. 68, 1958.
3. Barlow, ref. 2, pp. 80–91.
4. Barlow, ref. 2, p. 82.
5. The popular name for a book that had the formal title, *Journal of researches into the natural history and geology of the countries visited during the voyage of* H.M.S. Beagle *round the world, under the Command of Capt. Fitz Roy, R.N.*
6. Barlow, ref. 1, p. 40.
7. Darwin, C., *The Life and Letters of Charles Darwin,* D. Appleton, New York, p. 43, 1896.
8. Berra, T.M., *Darwin and His Children: His other Legacy*, Oxford University Press, New York, p. 62, 2013.
9. Berra, ref. 8, p. 43.
10. Berra, ref. 8, p. 187.
11. Berra, ref. 8, pp. 43–48.
12. Berra, ref. 8, p. 75.
13. Darwin, ref. 7, p. 81.
14. Darwin, ref. 7, pp. 81–82.
15. Darwin, ref. 7, p. 82.
16. Maddox, B., Deconstructing Darwin, *Discover Magazine*, p. 40, November 2009.
17. Darwin, C., *On The Origin of Species*, John Murray, London, p. 200, 1859.
18. Darwin, ref. 17, pp. 200–201.
19. Darwin, ref. 17, p. 201.

Absolute values in redshift quantization, and distances

I've always loved (and I still do) the paper of Dr Russ Humphreys regarding redshift quantization,[1] but apart from space expansion, which I understand he is not in favour of anymore, I've got two other questions at this stage.

Humphreys wrote:

> "The appropriately named Hubble Space Telescope can now photograph galaxies as far as 15 billion light years away."

Although the universe is supposed to be about 15 billion years old according to the big bang model, 15 billion light-years is, according to the big bangers, neither the distance of the farthest-out celestial objects when they started emitting the light we are receiving now (it's about 2.5 billion light-years) nor the distance where these farthest-out celestial objects are supposed to be now (it's about 33 billion light-years). (These numbers can be found by using the big bang cosmological calculators widely available on internet, with redshift z = 11.9 for the most distant galaxy.)

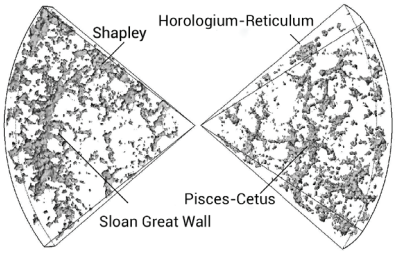
So is the 15 billion light-years Humphreys' view of the distance, and what then is its meaning (now or then)?

Humphreys also wrote:

> "That means the values of *z* tend to cluster around preferred values with equal spacings between them, such as: 0.00000, 0.00024, 0.00048, 0.00072, 0.00096, … . "

Lots of examples are then given as evidence of the spacings, but only very little reference is made to the absolute values of z, apart from the series above.

If one looks at the most published representations (by big bangers) of measured redshifts, they show them quantized per angle section around us, but their absolute values differ from subsection to subsection. Look, for example, at the Large-scale Structure in the inner parts of the 2 DOF Galaxy Redshift Survey:[2]



For example, one subsection may show z = 0.00000, 0.00024, 0.00048, 0.00072, 0.00096 … , but if the next subsection shows z = 0.00020, 0.00044, 0.00068, 0.00092 … , then the spacing would still be 0.00024 but the result won't be spherical groupings—it would look like the images above.

Therefore the matter of their absolute values, which must be statistically the same in all angular sections determined so far, is extremely important as far as the theory is concerned of them demonstrating that we are in the centre of the universe. So, if possible, I suggest more and better evidence of the same absolute values of the redshifts z in different angles, since these are essential to the whole case.

At least the following is some confirmation of the evidence, but it is still not sufficient to be convincing:

> "Furthermore the redshifts of quasars, BL Lac objects, galaxies within a cluster and 'distant' clusters are all quantized with peaks at z = 0.06, 0.30, 0.60, 0.96 (and beyond)."[3]

Fortunately, 0.06 = 0.00024 x 250, because if it was not a multiple of 0.00024, the concept of galaxies in spherical clusters around us would have been refuted.

Of course, if the effect of the local movement of the measurement base was not taken out and is the big reason for the images above not to show concentric circles, it would be great. But this sort of evidence, when corrected, will have to be given clearly and convincingly, and then, if possible, with the latest available data.

Hennie Mouton
Kuils River
Cape Town
South Africa

References

1. Humphreys, D.R., Our galaxy is the centre of the universe, 'quantized' redshifts show, *J. Creation* **16**(2):95–104, 2002; creation.com/our-galaxy-is-the-centre-of-the-universe-quantized-redshifts-show.
2. en.wikipedia.org/wiki/Observable_universe.
3. creation.com/a-different-view-of-the-universe.

» Russell Humphreys replies:

Mr Mouton's first question is easy to answer: I've always regarded the 15 billion light-years as a *minimum* radius for the galaxies in the universe, because that is roughly as far as our telescopes can observe them. How far away the same galaxies are now depends on cosmological models. If the universe is not actually expanding, as both John Hartnett and myself now believe is likely,[1,2] then those galaxies would still be at the same distance we see them now. In addition, God could have created lots of galaxies beyond 15 billion light-years. Maybe He wanted a radius of 100 billion light-years!

The second question is not as easy, because in the last decade big bang supporters have managed to thoroughly confuse themselves on the topic of redshift quantization, the bunching of redshifts, which is good evidence that (a) the cosmos has a geometric centre, and (b) our galaxy, the Milky Way, is near it. The Wikipedia review Mr Mouton cites is a good summary of how big bang supporters are thinking.[3] Their confusion seems to come from several factors:

1. *Failure to distinguish between nearby and distant galaxies.* The last paper showing clear redshift quantization was by Napier and Guthrie in 1997,[4] on which I based my 2002

paper.[5] They studied *normal* galaxies that are relatively close to us, within roughly 100 million light-years. I've always had the impression that the very clear fine structure they reported is likely to wash out at greater distances, say, several billion light-years, so that only larger redshift intervals could be observed at the greater distances.

2. *Failure to distinguish between normal galaxies and quasars.* Whatever quasars (quasi-stellar objects, QSO's) are, it seems fairly clear that they have large 'intrinsic' redshifts that add to whatever distance-caused redshifts they probably have.[6] The intrinsic redshifts could, and probably do, wash out any quantization in the distance-caused portion of QSO redshifts. All four of the redshift surveys the Wikipedia review cites after 1997 are either exclusively for QSO's or mix them in with normal galaxies indiscriminately. The reason is that QSO's comprise a lot of the larger redshifts (conventionally assumed to mean larger distances) they wanted to include in the studies. But because of that confusing factor, the four studies do not refute Napier and Guthrie.
3. *Failure to compensate for observer motion*. Napier and Guthrie compensated each redshift datum for the Doppler shift due to the sun's rapid motion around the centre of our galaxy, converting 'heliocentric' redshifts to 'galactocentric' redshifts. This procedure brought out the quantizations very clearly. One year earlier, WilliamTifft, the discoverer of redshift quantization, showed that good results came[7,8] by compensating for our galaxy's 600 km/second motion with respect to the cosmic microwave background radiation.[9] As far as I can see, the later papers neglect to do this chore, perhaps not realizing its importance.

Contrary to some critics, the Napier and Guthrie study was not within a narrow 'cone' of observations; they included all normal galaxies within about 100 million light-years of us. I'm convinced their study is still valid: redshifts from nearby normal galaxies are clearly quantized.

Because of the above confusions, the later studies have not refuted the possibility for redshift quantization (with larger intervals) at greater distances either. The Wikipedia article, in quoting a negative statement from a 2008 review, failed (because of bias?) to include this statement from the abstract of the same review:[10]

> "We conclude that galaxy redshift periodisation is an effect which can really exist."

John Hartnett has a good online study of the larger-distance redshift data.[11] He gives compelling evidence for large-scale redshift quantization. The confusion of big bang supporters—most of whom who have a strong desire not to find evidence for a cosmic centre, and especially not for us to be near it—is no reason for us to back away from this powerful argument for a Creator.

Russ Humphreys
Chattanooga, TN
UNITED STATES of AMERICA

References

1. Hartnett, J.G., Does the Bible really describe expansion of the universe? *J. Creation* **25**(2): 125–127, 2011; creation.com/bible-cosmological-expansion.
2. Humphreys, D.R., New view of gravity explains cosmic microwave background radiation, *J. Creation* **28**(3):106–114, 2014.
3. Wikipedia, Redshift quantization, January 2015, en.wikipedia.org/wiki/Redshift_quantization.
4. Napier, W.M. and Guthrie, B.N.G., Quantized redshifts: a status report, *J. Astrophys. Astr.* **18**:455–463, 1997; www.ias.ac.in/jarch/jaa/18/455-463.pdf.
5. Humphreys, D.R., Our galaxy is the cenre of the universe, 'quantized' red shifts show, *J. Creation* **16**(2):95–104, 2002; creation.com/our-galaxy-is-the-centre-of-the-universe-quantized-redshifts-show.
6. Hartnett, J.G., Quasar with enormous redshift found embedded in nearby spiral galaxy with far lower redshift: unsolved riddle for big bang astronomy, creation.com feature article, 12 January 2005; creation.com/quasar-with-enormous-redshift-found-embedded-in-nearby-spiral-galaxy-with-far-lower-redshift.
7. Tifft, W.G., Evidence for quantized and variable redshifts in the cosmic background rest frame, *Astrophysics and Space Science* **244**(1–2): 29–56, 1996.
8. Tifft, W.G., Redshift quantization in the cosmic background rest frame, *J. Astrophy. Astr.* **18**(4):415–433, 1997; www.ias.ac.in/jarch/jaa/18/415-433.pdf?origin=publication_detail.
9. Humphreys, ref. 5, p. 103; see ref. 28.
10. Bajan, K. *et al*., On the investigations of galaxy redshift periodicity, *Physics of Particle and Nuclei Letters* **4**(1):5–10; arxiv.org/pdf/astro-ph/0606294.pdf.
11. Hartnett, J.G., Our galaxy near the centre of concentric spherical shells of galaxies, 26 May 2014, johnhartnett.org/2014/05/26/our-galaxy-near-the-centre-of-concentric-spherical-shells-of-galaxies/.

Fossil snakes and the Flood boundary in North America

The placement of the Flood/post-Flood boundary in sedimentary rocks, assuming the geological column for sake of discussion, is important for creationists. If we misplace this boundary, our view of the Flood and the post-Flood world will be skewed. We need to spend much time analyzing the placement of this boundary, if we are to develop an accurate and sophisticated Flood model. With that in mind, I have a few comments on the perspective article by Chad Arment.[1]

Arment believes that if one finds two extant genera from the same kind at a fossil site, then that layer containing the fossil must be post-Flood. He applied this analysis to fossil snakes, but I imagine the argument can be made for other organisms as well. Moreover, the other extinct genera found with that particular extant genus must be post-Flood also, meaning this can be used to determine other post-Flood sites. The reason for this assumption is based on the following belief:

> "This is because the distinctive suite of anatomical characteristics that define a genus are unlikely to develop from ancestral stock in exactly the same way twice."[2]

It seems to me that Arment is assuming an accurate classification system with accurate definitions of

species, genus, family, and kind for fossils and living vertebrates. He also seems to assume that a genus would not have much variability and that the correct identification of the fossil has been made. I believe the main principle that we should not find two extant genera from the same fossil site, if from the Flood, needs to be developed more rigorously.

Fossils would be one criterion for attempting to find the Flood/post-Flood boundary, if we can figure out all the nuances of fossils and biostratigraphy. I think there is a better way for determining the boundary and that is to apply *multiple* criteria, since only one by itself, such as fossils, may be equivocal.

I have provided 32 criteria that can be applied for determining the Flood/post-Flood boundary.[3] When I apply these criteria to the western United States, where I live, I often find the boundary is in the early to mid Pleistocene, for instance in the Wind River Basin and the southern and central High Plains.[4] But I grant that because of uniformitarian dating and taxonomy problems, and many assumptions in their model, the boundary can be anywhere in the 'late Cenozoic', defined as the Miocene, Pliocene, or Pleistocene. Each area needs to be examined on its own merits, and 'Pleistocene' does not automatically mean the time of the Ice Age. Ice Age deposits are primarily found in the Late Pleistocene.

One criterion is the existence of coal at the surface. Coal is compressed plant matter that has been heated up and transformed. It takes a lot of rock above the coal to reach high enough temperatures for the transformation, and for coal found at the surface, this can give us a crude measure of late Flood erosion. We would not expect coal to form after the Flood, especially in view of the purity and thickness of many coal layers. How could hundreds of feet of trees and plants be gathered together in one place over hundreds of square miles, buried by a few thousand metres of sediments, and then re-eroded down to the level of the coal? Surface coal is an obvious Flood signature and not the result of post-Flood activity. There is plenty of 'Miocene' coal, the Miocene being the very early late Cenozoic. However, much strata had to cover this coal and then be re-eroded during the Recessive Stage of the Flood,[5] which would place the Flood/post-Blood boundary up into the Pliocene to mid Pleistocene at those locations.

Michael J. Oard
Bozeman, MT
UNITED STATES of AMERICA

References

1. Arment, C., Fossil snakes and the Flood boundary in North America, *J. Creation* **28**(3): 13–15, 2014.
2. Arment, ref. 1, p. 13.
3. Oard, M.J., *The Flood/Post-Flood Boundary Is in the Late Cenozoic with Little Post-Flood* Catastrophism, 2014, michael.oards.net/PostFloodBoundary.htm.
4. Oard, M.J., Relating the Lava Creek ash to the post-Flood boundary, *J. Creation* **28**(1): 104–113, 2014.
5. Walker, T., A Biblical geological model; in: Walsh, R.E. (Ed.), *Proceedings of the Third International Conference on Creationism*, technical symposium sessions, Creation Science Fellowship, Pittsburgh, PA, pp. 581–592, 1994.

» Chad Arment replies:

As my article was directly instigated by an online discussion with Michael Oard, I expected a response, but hoped that he would finally grapple with the argument itself. Unfortunately, he has only expressed his token opposition. Oard's call for rigorous development lacks conviction. He simply would like to be able to place the Flood boundary wherever he likes without having to worry about finding, say, both mastodons and mammoths on either side. I strongly doubt that creation scientists who are actually paleontologists or zoologists consider fossil anatomical evidence as 'equivocal' as Oard does.

In the case of North American snake fossils, there is good evidence to lay one of Oard's concerns immediately to rest. Oard states, "He also seems to assume that a genus would not have much variability." Oard's idea is that pre-Flood fauna was so variable in morphology that some Flood-destroyed genera and species would be close enough matches to fauna developing from post-Flood diversification in Ark-rescued genera as to be anatomically indistinguishable. For this to be true we should see a great diversity of species and genera within a pre-Flood kind (or at least a good number of potentially related genera, as hybridization data would be lacking). It would be silly to argue that 'much variability' would only result in a handful of look-alike species being found in the fossil record. So where is this great diversity in North American snake fossils?

As has been well explained in creationist literature, *Pantherophis*, *Lampropeltis*, and *Pituophis* are all in the same extant kind. If, as Oard implies, some fossil *Pantherophis*, *Lampropeltis*, and *Pituophis* could simply be fossil 'mimics' from pre-Flood populations, there should be a large number of other colubrids in the same fossil layers which share some characteristics (being in the same kind) but are different enough to be characterized as other species or genera. Holman's *Fossil Snakes of North America* only notes a few additional extinct *Elaphe* (*Pantherophis*) distinctive enough to separate into species (*E. buisi, E. kansensis, E. pliocenica*), one additional extinct *Lampropeltis* (*L. similis*), and no additional species of *Pituophis*.[1] Among the Colubrinae, the only fossil genera not attributable to extant taxa are *Ameiseophis* (a single small species known), *Pseudocemophora* (which may be related to *Lampropeltis* and *Cemophora*, bringing the latter into the *Pantherophis* kind), *Miocoluber*, *Paracoluber* (both morphologically similar to the extant racers of the genus *Coluber*), *Dakotaophis* (a very small snake with one recognized species), *Nebraskophis* (a distinctive genus without extant relatives), *Paraoxybelis* (based on poor material, and may be

synonymous to an extant genus like *Oxybelis*), *Pollackophis* (one small species with traits unique to all known Colubrinae), *Proptychophis* (a distinctively different rear-fanged colubrid), and *Texasophis* (small snakes, three North American and two European species noted). Most of these have very little in common with *Pantherophis*, and several (*Ameiseophis*, *Nebraskophis*, *Pollackophis*) may represent populations that went extinct with the Flood. There is no evidence of a wide diversity of large ratsnake-, kingsnake-, or bullsnake-like serpents unattributable to extant taxa in the fossil record. Therefore, there is no evidence that fossil specimens of *Pantherophis*, *Lampropeltis*, or *Pituophis* in North America would require separation into either post-Flood extant species or pre-Flood doppelgängers.

Regarding Oard's hand waving with Miocene coal, I can only reiterate that the method I am proposing applies to specific fossil beds and may not be suitable for broad stratigraphic brush strokes. So unless Oard finds a coal seam with an imbedded *Lampropeltis* fossil, I don't see the problem.

The Flood boundary problem is an interesting puzzle, but Oard seems to have forgotten the first rule of putting puzzles together—start with the corners first. Not all criteria are equal, and some starting assumptions are stronger than others. When the Bible says that only one pair of any terrestrial unclean kind was rescued on the Ark, that is a powerful starting point, and one that shouldn't be dismissed in favour of weaker arguments.

Chad Arment
Greenville, OH
UNITED STATES of AMERICA

References

1. Holman, J.A., *Fossil Snakes of North America*, Indiana University Press, Bloomington, IN, 2000.

C.S. Lewis: creationist and anti-evolutionist?

In 2011, I became aware of an article by Dr Jerry Bergman that appeared in *J. Creation* **23**(3):110–115, 2009. The article tries to make the case that in the later years of his life C.S. Lewis was a 'creationist and anti-evolutionist'. However, in an attempt to make this case (which is clearly not true), Bergman is forced to take small snippets of Lewis's quotes and tell the reader they mean something other than what they actually mean.

Let me start by making it clear that parts of the article do accurately characterize Lewis's views on the origins issue. In the section entitled "Opposes Evolution and Naturalism", Bergman does an excellent job describing Lewis's opposition to the *materialist* worldview. However, in the section labelled "The Funeral of the Great Myth", Bergman edits the writings of Lewis to make it sound like he believed something he clearly did not believe.

Bergman begins the section by stating, "Lewis, in his essay titled 'The Funeral of a Great Myth', explained why he regarded evolution as 'the great Myth of nineteenth and early twentieth century', one that he wanted to bury." However, that is not correct. Lewis specifically spelled out the Great Myth in the essay itself. He states:

> "I do not mean that the doctrine of Evolution as held by practising biologists is a Myth. It may be shown, by later biologists, to be a less satisfactory hypothesis than was hoped fifty years ago. But that does not amount to being a Myth. It is a genuine scientific hypothesis. But we must sharply distinguish between Evolution as a biological theorem and popular Evolutionism or Developmentalism which is certainly a Myth."[1]

Notice, then, that biological evolution was not the subject of "The Funeral of a Great Myth". Instead, it was "Evolutionism or Developmentalism". How does that differ from biological evolution? Lewis makes that clear in the essay:

> "In the science, Evolution is a theory about *changes*: in the Myth, it is a fact about *improvements*. Thus a real scientist like Professor J.B.S. Haldane is at pains to point out that popular ideas of Evolution lay a wholly unjustified emphasis on those changes which have rendered creatures (by human standards) 'better' or more interesting. He adds, 'We are therefore inclined to regard progress as the rule in evolution. Actually it is the exception, and for every case of it there are ten of degeneration.' (Darwinism Today, *Possible Worlds*, p. 28.) But the Myth simply expurgates the ten cases of degeneration. In the popular mind the word 'Evolution' conjures up a picture of things moving 'onward and upwards', and of nothing else whatsoever."[2]

So it is clear that Lewis is not trying to bury the hypothesis of biological evolution. He is trying to bury the myth that there is constant improvement throughout the course of history. This is the central problematic issue with Bergman's piece. He continually quotes Lewis, claiming that Lewis is discussing biological evolution. However, that's not what Lewis is discussing. He is discussing the Evolutionism or Developmentalism, which he has already distinguished from biological evolution.

Bergman then tries to back up his point by saying, "In 1951 Lewis wrote that evolution was 'the central and radical lie in the whole web of falsehood that now governs our lives' and modern civilization". However, if one reads the entire quote, one realizes this is not what Lewis meant.

The quote comes from a letter Lewis wrote to Captain Bernard Acworth, and here is the entire quote:

> "I wish I was younger. What *inclines me now to think* that *you may be right* in regarding it [evolution] as the central and radical lie in the whole web of falsehood that now governs our lives is not so much your arguments against it as the fanatical and twisted attitudes of its defenders [emphasis added]."[3]

Notice how Lewis is significantly more tentative than Bergman would have you believe. He didn't necessarily think what Bergman quoted was right. He was simply *inclined to believe that it may be right*. Also, Bergman adds, "and modern civilization" in his own words after the truncated quote. However, there is no mention of modern civilization in the entire letter.

Bergman then tries to show that Lewis thinks evolution is absurd by quoting from another letter. He says:

> "Lewis concluded that we live in what he called an absurd age. To illustrate this conclusion, he gave the example of a teacher who had been teaching evolution by explaining that 'life developed from simple organisms up to the higher plants and animals, finally to the monkey group, and from the monkey group to man'. Lewis concluded: 'You need much more *faith* in science than in theology'."

He references *Letters of C.S. Lewis, Revised and Enlarge Edition,* which was published in 1988 by Harcourt. It contains many of Lewis's letters, and the one, from which Bergman pulls the quote, is a letter from Lewis to his father. However, if you go to that letter, you find that Bergman has completely mischaracterized what Lewis wrote. Here is what the letter actually says:

> "We live in a most absurd age. I met a girl the other day who had been teaching in an infant school (boys and girls up to the age of six) where the infants are taught the theory of Evolution. Or rather the Headmistress's version of it. *Simple people like ourselves had an idea that Darwin said* that life developed from simple organisms up to the higher plants and animals, finally to the monkey group, and from the monkey group to man. *The infants however seem to be taught that* 'In the beginning was the Ape' from whom all other life developed—including such dainties as the Brontosaurus and the Iguanadon. Whether the plants were supposed to be descendants of the ape I didn't gather. And then people talk about the credulity of the middle ages!
>
> "*A propos of this can you tell me who said*, 'Before you begin these studies, I should warn you that you need much more *faith* in science than in theology' [emphasis added]."[4]

Notice that this is precisely the opposite of what Bergman claims. Bergman claims that Lewis said the teacher was teaching the standard tale of evolution and that he considered it to be absurd. However, the letter clearly shows that Lewis thought the part Bergman quoted was an accurate description of evolution. Lewis found what the teacher was teaching (that everything evolved from the apes—something Bergman never quotes) to be absurd. Also, note that Lewis did not conclude that you need more faith for science than theology. He was asking his father for the source of that quote!

This leads me to perhaps one of the most egregious parts of Bergman's piece. Bergman writes, "Lewis stressed that the doctrine of evolution is 'certainly a hypothesis', adding that he has concluded 'the doctrine of Evolution as held by practicing biologists is … a less satisfactory hypothesis than was hoped fifty years ago.'" However, this is completely false. I have already quoted this part of "The Funeral of a Great Myth", above, but allow me to reproduce the relevant portion here, with the words Bergman edited out in italics: "*I do not mean that* the doctrine of Evolution as held by practising biologists *is a Myth. It may be shown, by later biologists*, to be a less satisfactory hypothesis than was hoped fifty years ago [emphasis added]."

Note the difference between Bergman's claim and what Lewis actually wrote. Bergman claims that Lewis himself concluded that evolution is a less satisfactory hypothesis than was hoped fifty years ago. However, Lewis concluded no such thing. He *conjectured* that *perhaps some biologists* in the future *might* conclude that. This is clearly a case of Bergman (seemingly intentionally) misrepresenting C.S. Lewis by cutting up a quote to substantiate his own position!

But what of Bergman's overall point? Even though he has clearly mischaracterized Lewis's writings, it's possible that Lewis still was a "creationist and anti-evolutionist". Was he? Of course not. In Lewis's essay "The Funeral of a Great Myth", he makes it clear what he is willing to accept from evolution and what he is not willing to accept:

> "Again, for the scientist Evolution is purely a biological theorem. It takes over organic life on this planet as a going concern and tries to explain certain changes within that field. It makes no cosmic statements, no metaphysical statements, no eschatological statements. Granted that we now have minds we can trust, granted that organic life came to exist, it tries to explain, say, how a species that once had wings came to lose them. It explains this by the negative effect of environment operating on small variations. It does not in itself explain the origin of organic life, nor of the variations, nor does it discuss the origin and validity of reason**.** *It may well tell you how the brain, through which reason now operates, arose*, but

that is a different matter [emphasis added]."[2]

Note that Lewis says evolution cannot explain the origin of life or the origin of the mind. However, he is more than willing to accept that it tells us how the brain arose. That is clearly macroevolution, and Lewis was willing to accept that. He makes it even more clear in an essay entitled, "The World's Last Night". He says:

> "In the second place, we must notice that Darwinism gives no support to the belief that natural selection, working upon chance variations, has a general tendency to produce improvement. The illusion that it has comes from confining our attention to a few species which have (by some possibly arbitrary standard of our own) changed for the better. Thus the horse has improved in the sense that *protohippus* would be less useful to us than his modern descendant. *The anthropoid has improved in the sense that he is now Ourselves* [emphasis added]."[5]

Note that Lewis gives two examples of changes that he thinks have actually happened over time. The first is the change from *protohippus* to the modern horse. One could argue that this was a microevolutionary change, even though Lewis never used that term. However, he then says the other change is that from an anthropoid to ourselves. That is clearly a macroevolutionary change, and Lewis is willing to accept that it happened, even though he never used that specific term.

Of course, serious scholars who have studied Lewis's works and quote them verbatim have come to the same conclusion. For example, John G. West recently wrote a book entitled, *The Magician's Twin: C. S. Lewis on Science, Scientism, and Society*. It is a thorough discussion of Lewis's views on science, including the science related to origins. Here is how West describes Lewis's views on evolution:

> "Lewis addressed three kinds of evolution in his writings: evolution as common descent (the idea that we came from one common ancestor); evolution as a Darwinian process of unguided natural selection acting on random variations; and evolution as a social philosophy that explained away religion, morality, and human dignity. Lewis didn't object in principle to evolution as common descent (evolution #1), although he placed some important limits on the idea, and by the end of his life he grew more skeptical of this claim due to things like the Piltdown Man hoax. At the same time, Lewis clearly rejected unguided natural selection (evolution #2) as sufficient to produce both the human mind and the kinds of exquisite functional complexity we see throughout nature. In fact, he believed that Darwinian accounts of the development of human reason undermined our confidence in reason. Lewis also rejected Darwinism as a social philosophy (evolution #3), especially efforts to promote eugenics (trying to breed a superior race) and efforts to debunk morality as merely the product of survival of the fittest."[6]

As West tells us, then, Lewis was far from a committed theistic evolutionist. At the same time, however, he was equally far from a creationist or anti-evolutionist. He didn't object, in principle, to macroevolution (common descent), although he became more skeptical (not anti-macroevolution, just more skeptical of macroevolution) later in life.

This is confirmed by Lewis's own adopted son, Douglas Gresham. In October of 2011, I sent Bergman's essay to the C.S. Lewis Foundation, asking for a Lewis scholar to review Bergman's article. I specifically wrote, "I am trying to find a serious scholar of C.S. Lewis to evaluate an article from Creation Ministries International (CMI). I personally think it severely mischaracterizes Lewis's views, and I am trying to get CMI to retract it." The Foundation sent Bergman's article to Lewis's son, who replied as follows (please note that Lewis's friends and family referred to him as 'Jack'):

> "You are of course completely right. The ex-contextualisation of quotes, in a piece of creative and pseudo-explicative writing can make them mean practically anything, particularly if the minds of the readers are cleverly steered by self-conceived explanatory notes between the quotations as it seems to me that they are in this piece.
>
> "To say that Jack 'believed' in 'evolutionism' (as it is presented today) would be a lie, but to take what he wrote on the borders of this artificially extreme topic out of context to propel one's own 'creationist' barrow is equally mendacious."[7]

In the end, this article does a disservice to creationists everywhere. It is, at best, a result of careless scholarship. At worst, it is a classic example of the dishonest quote-mining that evolutionists routinely accuse creationists of doing.

Jay L. Wile
Anderson, IN
UNITED STATES of AMERICA

References

1. Lewis, C.S. and Hooper, W., *Christian Reflections*, William B. Eerdmans, Grand Rapids, MI, p. 83, 1967.
2. Lewis and Hooper, ref. 1, p. 85.
3. Hooper, W. (Ed.), *The Collected Letters of C.S. Lewis: Narnia, Cambridge, and Joy (1950–1963)*, vol. 3, HarperCollins, New York, p. 138, 2007.
4. Lewis, C.S., *Letters of C.S. Lewis, rev. and enlarged edn*, Harcourt Brace, New York, p.227, 1988.
5. Lewis, C.S., *The World's Last Night and Other Essays*, Harcourt, New York, *p. 103,* 1987.
6. live.hollywoodjesus.com/?cat=24, accessed 28 January 2014.
7. Gresham, D., private communication; blog.drwile.com/?p=6336.

» **Jerry Bergman replies:**

My brief response to Jay Wile's letter concerning my article on C.S. Lewis and his beliefs on creation/evolution follows. I am not able to respond to much of Wile's paper due to severe space limitations. In short, he claims that Lewis was an evolutionist who accepted macroevolution (Wile's term), and I concluded he (Lewis) supported both intelligent design and, at least toward the end of his life, creationism.

I and my co-authors, two of whom are well-known C.S. Lewis scholars who have published several books on Lewis, are writing a book on Lewis and evolution. We document that Lewis was, at least in the latter years of his life, a 'creationist and anti-evolutionist'. Faye Ann Crowell completed a thesis titled *The Theme of the Harmful Effects of Science in the Works of C.S. Lewis* (Texas A & M University) that also eloquently documented our conclusions. The belief that Lewis was an evolutionist comes from some ambiguous statements that Lewis made not long after leaving atheism and becoming a Christian.

Lewis composed 74 books, including several essay collections published after his death, and one could selectively quote from his writings to 'prove' he was an atheist, an evolutionist, or a creationist, as I used the terms. Although parts of my paper could have been worded differently, I stand by all of my conclusions. Wile has managed to find three, possibly four, examples that *appear* to support his position. He then attempts to refute the several score of quotes that I have taken from the remarkably wide range of subjects that Lewis wrote about in his nine books and about 30 essays that explored science and its impact on modern culture. As Wile noted, CMI did an analysis of my paper and his charges and concluded that I was correct.

One of the first published articles that concluded Lewis was not an evolutionist was by anti-creationist Ron Numbers and Professor Ferngren. In some of his early writings, such as *Mere Christianity*, Lewis appeared to accept some evolutionary ideas, at least in part, but as he researched the subject, his writings reflected a vivid opposition to the 'Great Myth' of evolutionary naturalism. As Ferngren and Numbers conclude, with study and reflection, "Lewis grew increasingly uncomfortable with the claims being made for organic evolution."[1] Numbers added that, privately, Lewis found the

> "… arguments against evolution increasingly compelling—and the pretensions of many biologists repellent. In 1951 he confessed … *the* central and radical lie in the whole web of falsehood that now governs our lives is … the fanatical and twisted attitudes of its defenders."[2]

Books that influenced Lewis's opposition to Darwinism include *The Everlasting Man*, written by G.K. Chesterton, which suggested that the enormous gap between humans and the apes and other primates argued against human evolution.[3] Lewis viewed *The Everlasting Man* book as so important that he credited it with moving him to fully embrace Christianity. As he wrote to educator Rhonda Bodle, "the very best popular defense of the full Christian position I know is G. K. Chesterton's *The Everlasting Man*".[4] If an evolutionist of any kind, he would not have stated this about Chesterton's book, but rather would have strongly disagreed with it. The following quote used by Wile supports my position that Lewis supported small changes, often termed microevolution, but does not support, in contrast to Wile's claim, macroevolution. In other words progress is not "the rule in evolution. Actually it is the exception, and for every case of it there are ten of degeneration." This supports genetic entropy causing genetic meltdown.

C.S. Lewis (1898–1963)

Lewis adds that we must sharply distinguish between "Evolution as a biological theorem and popular Evolutionism or Developmentalism which is certainly a Myth". From the context it is apparent that by Evolutionism or Development he means common ancestry, or what some would term macroevolution. By evolution, as I made clear, I mean Developmentalism (that which causes *improvements*), not evolution which causes small observable changes, as Lewis defined the term.

As to "What *inclines me now to think* that *you may be right* in regarding it [evolution] as the central and radical lie in the whole web of falsehood that now governs our lives is not so much your arguments against it as the fanatical and twisted attitudes of its defenders", I do not find the differences he notes "significantly more tentative", but trivial. In my original paper I included the words Jay Wile italicized, but space constraints, as also apply to this response, required cutting the original paper wherever I could. Also, assuming Wile has a point in no way negates my conclusion.

I added 'modern civilization' because Lewis was obviously not talking about

ancient, but modern, civilizations. This objection is irrelevant.

As for the concern about the teacher teaching the standard tale of evolution, Lewis was *not*, according to the quote, saying that "the teacher was teaching the standard tale of evolution" but rather that *Simple people like ourselves* had an idea that Darwin said *that life developed from simple organisms up to the higher plants and animals, finally to the monkey group, and from the monkey group to man*. Lewis added that "The infants however seem to be taught that 'In the beginning was the Ape' from whom all other life developed." It is obvious that his statement, "You need much more *faith* in science than in theology [emphasis in original]", *refers to both views*.[5]

The fact is Lewis wrote, "*It may be shown, by later biologists*, to be a less satisfactory hypothesis than was hoped fifty years ago", which is not what Wile claimed: instead he claimed Lewis said, "He *conjectured* that *perhaps some biologists* in the future *might* conclude" that it may be a less satisfactory hypothesis than was hoped fifty years ago. This point is nit picking and goes against much of what Lewis wrote. I cut it back in an effort to meet CMI's word limit. The fact is Lewis wrote much about the 'myth' of Darwinism in his later writings, showing that his thinking developed well beyond his early speculations about evolution. When Lewis traced the history of science, he noted in his usual literary style that "Darwin and Freud let the lion out of the cage", resulting in much harm to society, and

> "Science was not the business of Man because Man had not yet become the business of science. It dealt chiefly with the inanimate … [until and] when Darwin starts monkeying with the ancestry of Man and Freud with his soul … then indeed the lion will have got out of its cage."[6]

It is my conclusion, and that of numerous other Lewis scholars, that Lewis was toward the end of his life a 'creationist and anti-evolutionist' as I have defined the terms in my forthcoming book.

Lewis is clearly not an evolutionist as commonly defined. When he wrote this book he was careful to not challenge the evolutionary establishment. Even then he wrote, "may well tell you". The fact is, Lewis wrote many seemingly contradictory statements that have to be interpreted in context. Even though one could selectively quote Lewis in an attempt to prove he was an evolutionist, I endeavoured to be consistent. One must look at all of his writings on this topic to understand the few places where Lewis *appears* to be a macroevolutionist. To be consistent, Lewis's statement, "It may well tell you how the brain, through which reason now operates, arose", refers not to the evolution of the brain from some simple one-celled life-form, but to modern mankind's brain compared to the brain of men living in primitive societies.

In his Funeral essay, Lewis makes it clear that he accepted microevolution, but not macroevolution. This is clear in his statement:

> "… it [evolution] tries to explain, say, how a species that once had wings came to lose them. It explains this by the negative effect of environment operating on small variations. It does not in itself explain the origin of organic life, nor of the variations, nor does it discuss the origin and validity of reason."

By 'anthropoid' it appears that Lewis means a 'primitive' but fully human man, not a pre-human apeman as Darwinism teaches. In Lewis terminology, 'primitive man' could have been either 'unfallen man or early fallen man', not an ape on its way to evolving into a human.[7] What Lewis wrote elsewhere also argues for the view that he meant not an apeman evolutionary ancestor, but rather a primitive, but fully human, man. Lewis stated in the chapter on 'The Fall of Man', in *The Problem of Pain*, that the Fall "was transmitted by heredity to all generations, for it was the emergence of a new kind of man—a new species, never made by God, had sinned itself into existence".[8]

True Lewis did not use the term 'microevolution' but clearly implied this in his writings, as noted above. The expression "*protohippus* to a modern horse" clearly could refer to microevolution, as accepted by some creationists today.

I disagree with Wile's interpretation of John West that he lifted out of the book West edited. West wrote that

> "Lewis clearly rejected unguided natural selection (evolution #2) as sufficient to produce both the human mind and the kinds of exquisite functional complexity we see throughout nature. In fact, he believed that Darwinian accounts of the development of human reason undermined our confidence in reason. Lewis also rejected Darwinism as a social philosophy (evolution #3), especially efforts to promote eugenics (trying to breed a superior race) and efforts to debunk morality as merely the product of survival of the fittest."

This hardly makes Lewis an orthodox evolutionist. One review, which summarized much of this book, explores Lewis's views on Darwinism:

> "West lays to rest the myth that Lewis was a gung-ho theistic evolutionist. He admits that Lewis often accepted the plausibility of some kind of common descent. However, later in life he became more skeptical about any form of evolution ... . Two of the most interesting findings by West are: 1) that Lewis was skeptical of Darwinism before he even converted to Christianity; and 2) that Lewis consistently rejected one major feature of Darwinian evolution: its insistence on random, non-teleological processes."[9]

Wile noted Lewis's adopted son, Douglas Gresham disagrees with

my conclusions. Gresham's claims reflect the popular media claims, not a careful study of his stepfather's views. I once asked John Eisenhower about his father's religious beliefs and he responded that Dwight was an atheist. I have written a book on Dwight Eisenhower's religion and he was, in fact, a very committed Christian man.[10]

Professor Louis Markos wrote, if Lewis "were alive today, he would be an ID (Intelligent Design) person … [and] would have seen the flaws in Darwin and probably taken up the ID cause".[11] Professor Harold Bloom of Yale, an agnostic Jew who opposed Evangelicals and personally knew, and was a fairly close friend of, Lewis and even attended some of his lectures, wrote that Lewis's "attitude towards Evolution … differs from Creationism only in degree, not in kind. Indeed, Intelligent Design is a kind of parody of Lewis's general view of a Christian cosmos".[12] Owen Barfield wrote that Lewis "didn't believe in evolution … . Now Lewis, as you know, hated the idea of evolution."[13]

Harvard Professor of Psychiatry Armand M. Nicholi has, for over 30 years, taught a course in Freud at Harvard. The class eventually morphed into a course on both Freud and C.S. Lewis.[14] Dr Nicholi later wrote a book based on his Harvard course, contrasting and comparing the worldviews of these two intellectual giants. As is obvious from his text, Professor Nicholi is an expert on both men.

Both were reared in a religious environment, specifically Christian, both became atheists as adolescents, and both spent their life proselytizing—Freud for atheism and Lewis for theism, specifically Christianity. Nicholi documents how important Intelligent Design was in Lewis's conversion. In a chapter of his book titled *The Creator: Is There an Intelligence Beyond the Universe?*, Nicholi writes that as

> "… an atheist, Lewis agreed with Freud that the universe is all that exists—simply an accident that just happened. But eventually Lewis wondered whether its incredible vastness, its precision and order, and its enormous complexity reflected some kind of Intelligence. Is there Someone beyond the universe who created it? Freud answers this 'most important question' with a resounding 'No!' The very idea of 'an idealized Superman' in the sky—to use Freud's phrase—is 'so patently infantile and so foreign to reality, that … it is painful to think that the great majority of mortals will never rise above this view of life.'"[15]

Freud predicted that as the common people become better educated,

> "'…they would "turn away" from "the fairy tales of religion".' He reminds '… us that "the world is no nursery" and strongly advises us to face the harsh reality that we are alone in the universe … .' Lewis, after his changed worldview … asserts that the universe is filled with 'signposts' like the 'starry heavens above and the moral law within' … all pointing with unmistakable clarity to that Intelligence. Lewis advises us to open our eyes, to look around, and understand what we see."[16]

One fact that, Nicholi notes, deeply impressed Lewis was his observation that "our physical universe … is extremely complex … it comprises atoms, electrons, etc." and "the universe is not just the sum of its physical parts" but much more.[17] This sounds very much like the modern Intelligent Design movement. Conversely, Freud believed that science had shown that God is "so improbable, so incompatible with everything we had laboriously discovered about the reality of the world".[16]

Jerry Bergman
Toledo, OH
UNITED STATES of AMERICA

References

1. Numbers, R. and Ferngren, P., C.S. Lewis on Creation and Evolution: The Acworth Letters, 1944–1960, *The American Scientific Affiliation* **49**(1):28, 1996.
2. Numbers, R.L., *The Creationists: From Scientific Creationism to Intelligent Design,* Harvard University Press, Cambridge, MA, p. 175, 2006.
3. Gardner, M., *Fads & Fallacies in the Name of Science*, Dover, New York, p. 134, 1957.
4. Lewis, C.S., *Yours, Jack: Spiritual Direction from C. S. Lewis*, HarperOne, New York, p. 125, 2008.
5. Lewis, C.S., *Letters of C.S. Lewis, Revised and Enlarge Edition, Harcourt, New York,* p. 227, 1988.
6. Lewis, C.S., *They Asked for a Paper*, Geoffrey Bles, London, pp. 16–17, 1962.
7. Lewis, C.S., *The Collected Letters of C.S. Lewis, vol. 2: Books, Broadcasts, and the War 1931–1949*, Harper, New York, p. 207, 2004.
8. Lewis, C.S., *The Problem of Pain*, MacMillan, New York, p. 79, 1947.
9. Weikart, R.C.S., Lewis and Science, *Credo Magazine*, www.credomag.com/2012/10/24/c-s-lewis-and-science, p. 1, 2012.
10. Bergman, J., Religion and the presidency of Dwight Eisenhower; in: *Religion and the American Presidency*, Columbia University Press, New York, chap. 7, pp. 250–281, 2009.
11. Markos, L., email to Jerry Bergman dated 12 September 2012.
12. Bloom, H., *C.S. Lewis (Bloom's Modern Critical Views)*, Chelsea House Publications, New York, p. 2, 2006.
13. Quoted in Poe, H. and R. Poe, *C. S. Lewis Remembered: Collected reflections of Students, Friends & Colleagues*, Zondervan, Grand Rapids, MI, pp. 10, 35, 2006.
14. Nicholi, A., *The Question of God. C. S. Lewis and Sigmund Freud Debate God, Love, Sex, and the Meaning of Life*, The Free Press, New York, p. 5, 2002.
15. Nicholi, ref. 14, p. 36.
16. Nicholi, ref. 14, pp. 36, 37
17. Nicholi, ref. 14, p. 54.

Battle for the Bible in the early church

Benno A. Zuiddam

Is the Bible the reliable Word of God or a fallible collection of human religious ideas? The purpose of this article is to show that the conflict between secular science and the Bible is not new, but dates back to the days of the early church. Greek scientists like Porphyry and Celsus questioned the reliability of the contents of Genesis, Jonah, Daniel, as well as the factuality of Jesus' Virgin Birth and Resurrection. This paper will demonstrate how early Greek scholars alleged that the holy Christian Scriptures were unreliable productions of men and will consider the commitment of the early church to these writings as the voice of God.

Often research articles have the aim of stating something that is experienced as new and relevant for a limited group of colleagues with expert knowledge. This paper has a different purpose, namely to translate some of these results from the field of patristic studies[1] and make them available to fellow Christian scholars who are active in the natural sciences. This is likely to be encouraging, as the world of the early Christians was in many ways like the post-Christian Western world of the 21st century. What early Fathers embraced as Scripture is now usually also found in our printed Bibles. The fact that they took the Bible as the literal voice of God does not imply their interpretation was always right or that they were unaffected by the philosophies and pressures of their time and cultural surroundings. Likewise for Greek science in the late ancient era: although some philosophers preceded the modern 'unbelief' of the Continental Enlightenment Theology in many ways, this article does not claim that their worldview or motivation was identical, or deny that their work is inconsequential when it comes to considering the unusual or 'miraculous' in their own tradition.

This contribution is about the nature of Scripture in the eyes of prominent pagan scientists and early church leaders. It does not reflect on the history of the canon of the 66 books of the Bible as most Protestants know it, or the value of the deuterocanonical writings. 'Bible' is used in the sense of 'Scripture' as early Christians received portions of what they considered God's recorded revelation.

Two views of Scripture

Initially Christianity was a minority religion that faced ridicule and animosity, from society at large but from some scientists in particular. There often was a difference in worldview. For instance, several Greek scholars believed that the earth was extremely old or, like Aristotle, that is had always been there.[2] In late antiquity the Christian and Jewish idea of a creation 'only' a few thousand years ago was frowned upon at least by some.

The alleged facts of the Bible were cause for ridicule. Like today, Christian teachings about the incarnation of God and Jesus' Resurrection from the dead were considered farfetched. The Greek scientists who opposed Christianity preferred naturalistic explanations: Jesus made up the story about his virgin birth and his disappointed friends invented the Resurrection. The Bible was a book of myths and fairy tales. Christians were criticized for relying on Jewish traditions.

Still, in this climate, the early church gave evidence of a commitment to a Christian worldview that finds its basis in revelation. This is clear from the earliest stage: Clement of Rome, Theophilus of Antioch, Irenaeus of Lyons and Clement of Alexandria. Their writings show an early and natural acknowledgment of, and commitment to, the authority of Holy Writ as lively oracles of God.[3]

Modern tradition

Today much of the criticism and unbelief that was first voiced by pagan scientists, and then repeated in elitist circles by liberal theologians of the 19th century, is now presented as new and modern in popular media.[4] The general drift of this 'enlightened' criticism is that while two thousand years ago people had a primitive worldview, mankind has advanced so much since then that a reinterpretation of the Bible and its teachings is long overdue.[5]

More than half a century ago this approach had already become commonplace at most universities in the UK and the continent of Europe. In 1959 C.S. Lewis lectured in Cambridge on this subject:

> "I find in these theologians a constant use of the principle that the miraculous does not occur. Thus any statement put into our Lord's mouth by the old texts, which, if he had really made it, would constitute a prediction of the future, is taken to have been put in after the occurrence which it seemed to predict. This is very sensible if we start by knowing that inspired prediction can never occur. Similarly in general,

> the rejection as unhistorical of all passages which narrate miracles is sensible if we start by knowing that the miraculous in general never occurs. Now I do not here want to discuss whether the miraculous is possible. I only want to point out that this is a purely philosophical question. Scholars, as scholars, speak on it with no more authority than anyone else. The canon 'If miraculous, then unhistorical' is one they bring to their study of the texts, not one they have learned from it. If one is speaking of authority, the united authority of all the biblical critics in the world counts here for nothing. On this they speak simply as men; men obviously influenced by, and perhaps insufficiently critical of, the spirit of the age they grew up in."[6]

A 21st-century poll[7] found that one third of Church of England clergy doubt or disbelieve in the physical Resurrection and only half are convinced of the truth of the Virgin Birth. The poll of nearly 2,000 of the church's 10,000 clergy also found that only half believe that faith in Christ is the only route to salvation. Many doubt whether a naturalistic explanation for the Resurrection story is not to be preferred above the traditional teachings of the church. In the words of the famous quote from the creator of Sherlock Holmes, Arthur Conan Doyle, Sr (1859–1930): "Once you eliminate the impossible, whatever remains, no matter how improbable, must be the truth." Once the possibility of intervention or action by God is rejected as a theoretical impossibility, one is left with a revived body that did not really die or with an invented Resurrection. This train of thought is not new. One may be surprised to learn that this is more or less exactly what the Greek scientists were saying 1,800 years ago.

Scientist

Until a few centuries ago, the word 'scientist' did not really exist. Philosophy also included science. This is still visible when scientists earn a Ph.D., which translates as a doctorate in philosophy. The scientists of ancient Greco-Roman times were commonly known as philosophers. They concerned themselves both with matters of worldview and empiric science. Neo-Platonism was an influential school in late antiquity, a revival of some of the ideas of the Greek philosopher Plato. Otherwise it was an eclectic movement, which borrowed from other scholastic worldviews. Some combined this with Epicureanism (Acts 17:18), others with forms of Agnosticism.

Apostate Christians

History would remember Celsus and Porphyry[8] as prominent scholars who launched vehement attacks on the Scriptures. Their worldview focused very much on the here and now, like Epicurus of Samos in his philosophy. For Porphyry, the divine was a sphere that man was not able to pry into. The world of the gods was 'unknowable' in principle. In this respect the movement is not dissimilar to Agnosticism today.

Celsus and Porphyry came up with naturalistic explanations of what Christians received as special acts of God. Celsus published his *Real Truth* about Christianity and its teachings, while Porphyry wrote a series of fifteen books *Against the Christians.*

For historical context it should be realized that the founder of Neo-Platonism, Ammonius of Sakkas, was an apostate Christian. This is not unlike Professor Dawkins, who went through an intensely religious period in his teenage years and even made a profession of faith in the Church of England. His autobiography[9] does not describe any negative behaviour of Christians that triggered his conversion to atheism. On the contrary, he writes with a measure of respect about his former headmaster, who was at that stage an important religious influence on his life:

> "While Sunday morning service was in St Mark's, every weekday morning and every evening we had prayers in the school chapel. Gallows was extremely religious. I mean really religious, not token religious: he truly believed all that stuff, unlike many educators (and even clergymen) who pretend to do so out of duty... ."[10]

Porphyry, who was known as the greatest enemy of Christianity, initially took a serious interest in Christianity in his youth and was intrigued by Christian leaders, like Origen of Alexandria (and later Caesarea).[11] From what survives from his writings he knew his Bible better than many Christians today. It was only after bad experience with Christians in Caesarea that Porphyry rejected a religion that produced badly behaving people. How different history could have been if only Christians in Caesarea had behaved differently! Multiple factors may hide beneath the surface of an intellectual rejection of Christianity and its teachings.

Another important factor was that Jesus and his Apostles failed to live up to the ideals of the Greek shame culture. This is not unlike 21st-century neoliberalism, which esteems people and achievements largely on an economic basis. In modern terms Jesus and His Apostles were failures. They were neither respectable nor successful in Greek terms. Jesus' disciples left steady jobs and positions in society for an uncertain future, following a master who lived off the support that rich women and others might provide. The crowds followed him for miracles but could not bear His teaching and deserted Him (cf. John 6). His enemies triumphed and Jesus died a shameful and cruel death. In the eyes of Porphyry and Celsus, Jesus had a profoundly unsuccessful life.[12]

Old Testament

They devoted much of their attention to criticizing the Bible. Celsus rejected Christianity's claims that Jesus was the fulfilment of a long tradition of prophecies. "[You Christians] quote prophets as foretelling facts about Jesus' life before they happened, ... but those prophecies could be much better applied to thousands of other people" (*Contra Celsum* II.28).[13] For Celsus the Old Testament contained many implausible stories, like the barbaric folktale about Lot and his daughters (C.C.IV.45). Two millennia later Old Testament handbooks for Christians agree: an aetiological myth, an unhistorical folktale to discredit the origin of the nation of the Ammonites.[14] Jonah's adventures with the big fish were just preposterous fiction; as was Daniel and the lion's den (C.C.VI.53).

It was not by accident that the Greek scientists attacked the prophets Jonah and Daniel in particular. With Porphyry in particular, assaults on Old Testament prophets function as attacks on Christ. Jesus made direct comparisons between Himself and Jonah (Matt. 12:40). He also saw some of Daniel's prophecies as things yet to be fulfilled (Matt. 24:15). Chapters 8–12 of Daniel contain a lot of information that points to a future arrival of the Messiah in the time of Jesus. For this reason Porphyry came up with the idea that the whole book of Daniel was really a fake, produced by a pseudo graphic author. It really described events that had already taken place in the second century BC, but portrayed these as alleged prophecies from the prophet Daniel who had passed away centuries before. Hieronymus (better known as Jerome) preserved much of Porphyry's criticism in his *Commentary on Daniel*. From his prologue:

> "Porphyry wrote his twelfth book against the prophecy of Daniel, denying that it was composed by the person to whom it is ascribed in its title, but rather by some individual living in Judaea at the time of the Antiochus who was surnamed Epiphanes."

Today Porphyry's theory in some form is embraced by nearly all prominent Old Testament scholars.[15] The technical device is called *vaticinium ex eventu*. This is Latin for a 'prediction from the event'. It means writing about events that have already happened as if the author were living before they took place. In other words, we say that Daniel prophesied about the "abomination that makes desolate" (Dan. 11:31; 12:11) as a future event, while in fact it was someone laying these words in Daniel's mouth hundreds of years later, at the time when the sanctuary was defiled by a Syrian king. The words were only attributed by Daniel to lend them credibility. As the actual desolation allegedly took place two hundred years before Christ, Jesus was wrong both in His reference to the prophet Daniel and in His view that the abomination as a still outstanding event (see Hieronymus, *Commentary on Matthew, 24:16*).

Figure 1. For early Christianity the Scriptures were literally inspired by God. Rembrandt (1606–1669), *The evangelist Matthew and the angel* (1661).

Life of Jesus

After the Scriptures of the Old Testament, it was the life of Jesus that came under scrutiny. Celsus and Porphyry denied and discredited Jesus' incarnation, His teachings and His Resurrection.

To start with Jesus' incarnation—Christ taking on the body of an unborn baby, this was shameful and preposterous in the eyes of the Greek scientists. It was not appropriate for a god to enter this world as a baby.[16] Celsus thought the idea of a conception without visible involvement of a man was borrowed from the Greek myth about the god Zeus changing himself into golden rain to impregnate one of the beauties he fancied (C.C.I.37). The Virgin Birth was just a cleverly devised tale to mask Jesus' illegitimate birth as the result of a liaison between Mary and a Roman soldier. "The mother of Jesus was rejected by the carpenter to whom she was engaged, because she was found guilty of fornication, and had a child of a certain soldier called Panthera" (C.C.I.32). This name was probably a slur, as 'Panthera' translates as 'predator of all'.

Not surprisingly for Neo-Platonists, some of the better elements of Jesus' teachings were dependent on Plato—for instance, Jesus' teachings on riches and the parable

of the rich man and the needle (Matt. 19:24). Plato taught that it is "impossible for an extraordinary good man to be extraordinarily wealthy" (C.C.VI.16). But as for his prophecies and the Gospel portraying Jesus as someone who knew the future (Matt. 17:22, 20:18), this was all invented by the disciples and Gospel authors. Of course Jesus did not know the future. This was just a tribute in hindsight by his followers, who wanted the world to think about Jesus as a prophet. "Because the disciples couldn't reconcile themselves to the facts, they made up this plan to say that He had known everything before" (C.C.II.15). No, this Jesus was a loser, who attracted low social class people from Galilee and never had a proper job or position in life (C.C.I.62), while his teachings were rejected by everyone who counted in society and religious life at the time.

That in His Passion Jesus took on Himself the sins of the world was just a way of His followers making sense of his disgraceful rejection by society. It was attributed and in the mind of the beholder, but the fact of the matter was that Jesus died a cruel and shameful death, and that His life wasn't a success story. Celsus showed himself a real psychologist in explaining away the Resurrection of Jesus. This was a story invented by His disciples, who suffered from severe grief and hallucinations, finding it extremely hard to come to terms with the death of their master (C.C.II.55). Yes, they may have experienced profound spiritual impressions, but this should not be regarded real in any scientific sense (C.C.II.61).

Technically, according to Celsus (C.C.III.26), the Resurrection appearances of Jesus were dependent on Herodotus' account of the life of the poet Aristeas (Ἀριστέας, *Histories IV*), from a Greek island, who reappeared on several occasions after his death. Celsus omits to say that according to Herodotus from day one of Aristeas's alleged death, there was first-hand testimony that he had not died at all and that those who said he had died could not find the body. A final and third appearance was said to have taken place 350 years later, in Italy that, by that time, had started to take over Greek culture, with the message to put up an altar for Apollo and a statue for Aristeas himself ... . For Porphyry the Resurrection stories were part of a cover up. It was easy to allege that Jesus appeared to an inner circle of followers. As these followers of Jesus were biased, who was to say this really happened? If Jesus had really come back from the dead, he should have appeared to Pilate and the Jewish leaders (*Apokritikos* II.14).

Apostles discredited

Both Celsus and Porphyry went to great length to discredit the Apostles and their teachings. Much of what they wrote in this regard comes under the header 'character assassination'. Matthew was completely negligent in leaving his responsible job as tax collector on the spot, to follow Jesus (Matt. 9:9). The Apostles were unlearned men, not able to recognize normal astronomical phenomena like a sun eclipse (Matt. 27:45, see Hieronymus *Commentary on Matthew*). They, like Jesus, did not have proper jobs, but shamefully lived off the wealth of women sympathizers (cf. Matt. 27:55–56, Luke 8:2–3). As with Jesus' alleged prophetic giftedness, there is a huge difference between what His followers wrote down and what really happened. The Apostle Peter actually murdered Ananias and his wife Saphira for their money (*Apokritikos 3.21*). The story about God killing them for a white lie was just a cover up (Acts 5:1–11). Hieronymus (*Ep. 130 ad Demitrius*): "The apostle Peter did not wish the death of Ananias or Saffira; of which he is falsely accused by Porphyry."

Otherwise the Apostles did not really know their Bible (*Apokritikos* III.33). Not only did they misapply prophecies to make them refer to Jesus, but they also wrongly ascribed quotes. Hieronymus (*On the beginning of Mark*):

> "This passage that impious man Porphyry, who wrote against us and vomited out his madness in many books, discusses in his 14th book and says: 'The evangelists were such unskilled men, not only in worldly matters, but also in the divine scriptures, that they attributed the testimony, which had been written elsewhere, to the wrong prophet.' This he jeers at."

Paul gives contradictory teachings on the circumcision (Acts 16:3, 1 Cor. 9:19) and also shares incompatible views on the Law of Moses as holy and good (Rom. 7:12) and as a curse (Gal. 3:10, cf. Rom. 3).

Christianity's expectancy of a bodily resurrection after this life was incompatible with the worldview of the Greek science of the day. Porphyry said in so many words that this was a ridiculous and unwarranted expectation. To illustrate this, he gives the example of someone who drowns, is eaten by fish, which are, in their turn, consumed by fishermen. These men ultimately die a violent death themselves and are eaten by dogs or wolves, which, in their turn, are devoured by vultures (*Apokritikos 4.24*). 'How can the original body be resurrected as it was part of so many different bodies?', Porphyry sneered.

The early church—Scripture as God's voice

While much of the Greek scholarly objection against the Bible and its teachings is commonly shared by society and scholarship in the 21st century, it is important to realize that the early church firmly rejected these views. Origen[17] (c. 184–254) wrote a lengthy apology against Celsus, which is the main reason why we still know about Celsus today. Among many other things, Origen confirmed the historicity of Genesis, including the episode of Lot and his daughters.

He put up an elaborate defence against most of the Greek scientific criticism as described in the first part of this article. Eusebius (c. 263–339), Hieronymus (c. 347–420), and Augustine (c. 353–430) all wrote against Porphyry and affirmed the authority of the Scriptures.

When one goes further back, to the second century, even to the generations that followed the Apostles, one can hardly miss two important church leaders who operated in different parts of the Roman Empire: Irenaeus of Lyons (c. 130–202 AD)[18] and Clement of Alexandria (150–215 AD).[19] Irenaeus worked in Gaulle, present day France. Clement was active in Egypt, in a city that was then the Greek cultural capital of the world. Both were recognized and influential bishops. Irenaeus helped settle the date for Easter when this became an issue for Christianity and wrote five books, *Against Heresies*. Not only are these books an important source for our knowledge of Gnosticism (mystical movements that were loosely based on Christianity), but they are also indicative of what the early church thought about Scripture.

The latter can also be said about Clement of Alexandria. His main works are the *Pedagogue*, the *Exhortation against the Greeks* and a *Patchworks* collection (Στρωματεῖς). Clement was a cultured author and his books contain more than 360 quotes from classical sources. He died in exile in Cappadocia after he fled Alexandria from persecution.

Figure 2. Origen of Caesarea wrote *Against Celsus*, which preserves much early criticism against the Bible. Portrait by André Thévet (1584).

At this point, rather than running the risk of losing the reader in the detail of an inductive methodology, I have opted for a topical overview of the approach of Irenaeus and Clement, only linking with the primary sources in a general way. Specific reference to the (Latin and Greek) texts, and/or the philological methodology underlying this research, has been provided in my earlier contributions on this subject.[20]

Natural reception of Scripture

Television documentaries and popular literature[21] sometimes give the impression that the Bible as we know it today was really the result of decisions that the church made centuries later. For instance, the canon of the Bible was supposedly decided in the 4th century, when Emperor Constantine ruled it over church councils and forced the church to accept certain books and keep others out. This is a misconception. From the writings of the early Church Fathers it is clear that Scripture as we know it was recognized ages before the church made any canon decisions about what should be allowed in the Bible. The primary sources from the first centuries indicate that the early Christians didn't need official pronouncements to accept these books.

As a rule, one finds that wherever a Bible book is available to a Church Father, it is also recognized as such. These writings had an inherent authority that was received locally, disregarding vast differences in region and distance. These books were also so much part of Apostolic Christianity from the very start that they were a natural part of the Christian tradition. This is also generally true for the deuterocanonical books of the Old Testament, the *Wisdom of Jesus Sirach* in particular. Because the Apostles in the New Testament books often use the Greek Septuagint to refer to the Old Testament, the early church considered the Greek Septuagint as an 'inspired' translation. As it contains the Old Testament Apocrypha,[22] the Roman Catholic Church regards these as Scripture as well, while Anglican, Lutheran, and Reformed Churches see these as a special category, distinct from normal books. Otherwise the numerous Scripture quotes by the Fathers of the second century show that, for all intents and purposes, they had the same Bible available as Christians today.

Scripture as carrier

How did the early Christians see Scripture and what was its function? From the outset it is important to consider that they saw God as a reality who was involved in this world from the start. For them God existed and communicated, not as a mere person, but as the Creator who stood at the beginning of everything. He created mankind for His special purposes and continued to make these known and relate to

his creatures by means of Holy Scripture. In this context, Clement of Alexandria says (ANF02)[23] that through the Bible Christians are '*theodidaktoi*' (*Stromateis* 1, cf. 1 Thes. 4:9); they are taught by God, who uses sacred letters: the Scriptures. God takes on the role of a heavenly educator who takes human beings by the hand, using the 'Divine Scriptures' and 'Holy Scrolls' to instruct them (cf. *Paed*.3).

So the Scriptures have a vertical dimension as God uses them to maintain a relationship with mankind and sheds his light on earthly affairs. On the other hand, in the works of Irenaeus and Clement there is also a strong horizontal function as Scripture sets the standard for right teaching and should as such be used to distinguish right from wrong. As the reliable Word of God it was the source *par excellence* that was proof in itself, as God's final say in the matter. The early church made extensive use of Scripture as proof of right teaching and as evidence to bring heresy to light.

Nature of Scripture and its authority

What can be said about the nature of Scripture as the early Christians experienced it?

Firstly, they did not see the Scriptures as a mere collection of inspiring religious views and experiences. To focus on each Bible writer with his own religious perspective, preference, and 'theology' is a post-Enlightenment development. The decisive factor with holy Writ for Irenaeus and Clement was that God was its ultimate author. Scripture was literally 'God-breathed', like the human voice is carried by breath. They did not mean this in the sense that it was stimulating and that in some way they believed God to have been involved in its coming to into being. 'Breathed' does not refer to a human production that was 'touched' or 'used' by God. It means that it was spoken by God, who also creates by means of speaking. God spoke and it was; the Bible starts with this refrain in Genesis 1. Irenaeus and Clement saw God as the ultimate author of Scripture. Yes, He used Moses and other prophets to pass on His message, but in the end those men were mere servants of the Word of God. For this reason the Church Fathers refer to the Holy Spirit as the 'mouth of God'.

Secondly, the early church considered Scripture literally as words from heaven or 'Word of God'. They saw Scripture as the result of an oracular process. They refer to it with the same word that the Greek religion used for literal messages from heaven, '*logia*', divine words at special sites where people came to enquire about the will of the gods. The early Christians applied this word, meaning a message that came straight from heaven, also to Bible books and to Scripture as a collection.[24] Where the Greeks often had to be satisfied with one-liners or very short messages from the 'gods', early Christianity was adamant that all Scripture, from Moses and the prophets to the Apostles and Evangelists, had oracular, and therefore authoritative, status.

Figure 3. Clement of Alexandria saw Scripture as "holy Letters and Syllables" which carried the voice of God. Portrait by André Thévet (1584).

Thirdly, while human authors were taken into God's service to pass on His Word, the vehicle of language that contained and preserved his precious message was also considered with special reverence. The end result of the 'inspiration process' that was committed to parchment or papyrus was literally regarded as "holy letters and syllables", because of the special use that God made of these to speak to his creation.

Clement of Alexandria

Fourthly, because of this strong emphasis on God as the author of Holy Writ, the early church did not experience tensions between Bible books. While heretics, like Marcion, and Gnosticism had difficulty with the Old Testament and the notion of God as Creator, this presented no problem for Irenaeus. Jesus spoke through Moses and Leviticus as much as through the Sermon on the Mount, and it was the Holy Spirit who sung the Psalms of David. Clement (*Protreptikos/ Exhortation* 1) has similar expressions: the Saviour sings in Psalms, speaks through a burning bush, speaks through Isaiah, Elijah and the mouth of the prophets.

All provided facets of God's truth and continued to reflect the mind of God. This also disciplined the theology of the

early church and her thinking about God. While heretics had the luxury of cutting and pasting as they pleased, the church had to do justice to all of Scripture, both in her thinking and practice.

Fifthly, the overall message of Irenaeus and Clement was that Scripture equalled truth and reliability. Whether they write about the Bible in a descriptive way or refer to Scripture in countless quotations, they regard this as the voice of God and the highest court of appeal. This was not only the case for moral principles or 'untestable' doctrinal ideas about God, but it also extended to factual and historical truth. In this the early church shows a consistent pattern, from very early Fathers, like Theophilus of Antioch, to Irenaeus, Clement, and Origen, to later Fathers like Eusebius, Hieronymus, and Augustine. Scripture is the voice of God and therefore morally, theologically, and factually authoritative. Because of this notion of Scripture as the reliable voice of God, indiscriminate of its place in human theological constructions, the early church was able to affirm the historicity of Genesis, Jonah, Daniel, the Virginal Conception and the bodily Resurrection of Christ alike. The early church was 'voice of God'-oriented, while Western Christianity has progressively become man-oriented. The history of several 19th-century theologians shows that there are no intellectually tenable halfway stations.[25]

Application—the whole counsel of God

It is evident from their writings that Scripture is used by the Church Fathers to direct lives and to learn more about God. However, the main application in the books of Irenaeus and Clement is providing proof from the premise that all Scripture is the Word of God.

In his first book, *Against Heresies*, Irenaeus presents his main argument against the Gnostics. What is wrong with their teachings? Their primary mistake, according to the Church Father, is that they distort the Scriptures to support what Irenaeus considered "their fiction". In other words, the Gnostics err in their wrong methodology. Instead, eagerness to do justice to Scripture and its message, they use it selectively to bolster preconceived ideas. In their reference they seem to be building on the Bible, but what they are saying is really out of context. There is no genuine desire to embrace Scripture as the Word of God, but only to use it for their own purposes. Irenaeus perceives a profound lack of integrity in this approach.

Clement of Alexandria has a similar message (*Stromateis/ Patchworks* 7). Heretics go wrong because they do not consider all Scripture. They do not compare what God has to say on a topic in several places and contemplate this with reverence to get the full picture. Or they err because their reference is either incomplete or out of context.

The early church heresy constituted a failure to recognize and respectfully treat all Scripture as the voice of God. Irenaeus ends (fifth book, *Against Heresies*) his argument with an invitation. He draws a parallel between Adam and Eve with the tree of life in Paradise and the church that gathers around the Holy Scriptures now. While initially Adam and Eve were allowed to eat from the tree of life, this privilege was lost after the Fall. In the New Testament situation the church is like the Garden of Eden, where a new tree of life is central: the Scriptures, the life-giving voice of God. Adam, where are you?

Conclusion—the voice of God

In this article we have met with two ancient views: the Scriptures as a fallible manmade invention (Greek scientists) and the Bible as the voice of God (early church). Despite the onslaught of Greek science and scholarship, the church was able to appreciate the Bible as the reliable Word of God from a very early stage. Their response was not the 'god of the gaps', or a vastly reduced Bible, but an intellectually integrated Scriptural worldview. This took a lot of work and meeting of minds, often in unfavourable circumstances. Persecution and discrimination were at least as commonplace then as they are today. Early church leaders embraced God's revelation; not in a selective and utilitarian way, but with an intellectually balanced and comprehensive approach. They did so as children of their time and with their own imperfections, but they did so nonetheless. In this sense they set an example for Christian scholars with similar commitments today. For them Scripture was essentially the vehicle for the voice of God and his truth. Consequently the church aimed at listening to God and find enduring intent behind the words of Holy Writ, the voice of the God who continues to speak.

References

1. Those who wish to familiarize themselves more intimately with this theme are referred to the author's following contributions to theological and patristic journals:
   - Old Critics and Modern Theology, *Dutch Reformed Theological J.* (South Africa) **XXXVI**(2):256–266, June 1995.
   - Holy letters and syllables: The function and character of Biblical authority in the second century, *Dutch Reformed Theological J.* **XXVIIII**(3):180–191, September 1997.
   - Λόγιον in Biblical Literature and its implications for Christian Scholarship, *Acta Patristica et Byzantina* **19**:379–394, 2008.
   - For further reading:
   - Hoffmann, R.J., *Porphyry's Against the Christians: the Literary Remains*, Prometheus Books, New York, 1994.
   - Benko, S., *Pagan Rome and the early Christians,* Indiana University Press, Bloomington, IN, 1986.
   - Hargis, J.W., *Against the Christians: the rise of early anti–Christian polemic*, Lang, New York, 2001.
   - Boberiz, C.A. and Brakke, D., *Reading in Christian Communities: essays on Interpretation in the early Church (CJAS)*, University of Notre Dame, Notre Dame, IN, 2002.
   - Meijering, E.P., *Als de uitleg maar goed is, hoe vroege christenen de bijbel gebruikten* [Striving for the right interpretation, how early Christians used the Bible], Meinema, Zoetermeer, 2003.

- Hauser, A.J. and Watson, D.F., *A History of biblical Interpretation, vol. 1 the ancient Period,* Eerdmans, Grand Rapids, MI, 2004.
- Rankin, D.I., *From Clement to Origen: the social and historical Context of the Church Fathers,* Ashgate, Eldershot, 2006.
- Soulen, R.N., *Sacred Scripture: a Short History of Interpretation,* John Knox Press, Louisville, KY, 2010.
- Gallagher, E.L., *Hebrew Scriptures in patristic biblical Theory, Canon, Language, Text,* Brill, Leiden, 2012.

2. See Aristotle, *Meteorology* 2.3. Other Greek scholars considered a young age for the earth, but by the 4th century the predominant view that confronted Christianity was that of an old earth, cf. Augustine, *De Civitate Dei 12.10–12* where Augustine rejects the Greek old earth view of Apuleius, and subsequently the idea that this world (as possibly one of many) regenerates itself over long periods of time, and where he specifically answers those who have a problem with the biblical account of the creation of man because it could not have happened less than six thousand years ago (reckoned from 4th century).
3. For a detailed treatment, see: Zuiddam, B.A., New perspectives on Irenaeus: Scriture as oracular standard, *Ekklesiastikos Pharos* **93**(22):288–308, 2011; Early orthodoxy: the Scriptures in Clement of Alexandria, *Acta Patristica et Byzantina* **21**(2): 257–268, 2010.
4. E.g. in the 2011 BBC TV series *Bible's Buried Secrets*, Dr Francesca Stavrakopoulou questioned whether King David's kingdom, as described in Samuel, did in fact ever exist. See: www.bbc.co.uk/religion/religions/christianity/texts/bible.shtml.
5. One of the most explicit proponents of this view is Spong, J.S., *A New Christianity for a New World: Why Traditional Faith is Dying and How a New Faith is Being Born*, Harper One, San Francisco, CA, 2002. The tendency to filter out the miraculous from the Bible had become a general one in the UK by 1950, as is witnessed by C.S. Lewis's lecture in Cambridge on *Modern Theology and Bible Criticism* (Essay from *Christian Reflections*, edited by Walter Hooper), which may also be found as an appendix in McDowell, J., *Evidence that Demands a Verdict, vol.2*, Thomas Nelson, Nashville, TN, p. 375–379, 1992.
6. McDowell, ref. 5, p. 377.
7.. *The Telegraph*, 31 July 2002: www.telegraph.co.uk/news/uknews/1403106/One–third–of–clergy–do–not–believe–in–the–Resurrection.html.
8. Benko, ref. 1, p.158: "The end of the second century was a period of serious clashes between paganism and Christianity ... . But at the same time, on a different plateau, a meeting of the minds began to occur."
9. Dawkins, R., *An Appetite For Wonder: The Making of a Scientist*, Harper Collins, San Francisco, CA, 2013.
10. Dawkins, ref. 9, p. 100.
11. Porphyry's criticism of the Scriptures was collected by Adolf von Harnack, *Porphyrius, "Gegen die Christen", 15 Bücher: Zeugnisse, Fragmente und Referate*, Abhandlungen der königlich prüssischen Akademie der Wissenschaften: Jahrgang 1916: philosoph.–hist. Klasse: Nr. 1, Berlin, 1916. Can also be found online at: archive.org/details/HarnackPorphyrius–GegenDieChristen. Porphyrian material is also found with the Church Father Macarius Magnes in his book *Apokritikos* (edn used Fougart, P., *Apokritikos*, Blondel, Paris, 1876). English readers are referred to the edition of Crafer, T.W., McMillan, London, 1919: www.tertullian.org/fathers/macarius_apocriticus.htm. R.J. Hoffmann published an updated translation in Porphyry's *Against the Christians: The Literary Remains*, Prometheus Books, 1994.
12. Hoffmann, ref. 1, p. 171: "The truth seems to be that Porphyry regarded Jesus as a criminal, justly punished for his crimes by the power of the Roman state, and hence undeserving of the status of hero or of the divinity conferred upon him by his misguided followers." Celsus regarded him as "a pestilent fellow who told great lies and was guilty of profane acts ... . Jesus collected around him a group of tax collectors and boatmen, wicked men, from the lowest level of society", Benko, ref. 1, p.150.
13. Chadwick, H., *Origen: Contra Celsum*, Cambridge University Press, Cambridge, 1980. In 1873 Th. Keim reconstructed Celsus' book on the basis of materials found with Origen: *Celsus' wahres Wort*, Orell, Zürich.
14. E.g. van Seters, J., *Prologue to history: the Yahwist as historian in Genesis*, John Knox Press, Louisville, KY, 1992. See also Sutskover, T., Lot and his Daughters (Gen. 19:30–38), further literary and stylistic Examinations, *J. Hebrew Scriptures* **11**: 1–11, 2011.
15. For a detailed treatment, see: Zuiddam, B.A., The shock factor of Divine Revelation: a philological approach to Daniel 8 and 9, *Scandinavian J. the Old Testament: An International J. Nordic Theology* **27**(2): 247–267, 2013. Since the 1820's OT scholars (Bleek, Von Gall, Wellhausen, etc.) generally opt for a Maccabean date for Daniel, three centuries after its alleged authorship. Hill, A.E. and Walton, J.H., *A Survey of the Old Testament,* Zondervan, Grand Rapids, MI, p. 571, 2009: "It seems that the presuppositional rejection of supernaturalism is often partly responsible for the rejection of a sixth-century date for the book."
16. The idea of shame culture in Greek antiquity is worked out in Dodds, E.R., *The Greeks and the Irrational*, University of Carlifornia Press, Berkely, CA, p. 26, 2004: "The application to conduct of the terms καλὸν and αἰσχρόν seems also to be typical of a shame-culture. These words denote, not that the act is beneficial or hurtful to the agent, or that it is right or wrong in the eyes of a deity, but that it looks 'handsome' or 'ugly' in the eyes of public opinion."
17. Greek: Ὠριγένης (*Origénes*).
18. Migne, P.G., for an English translation, e.g. Grant, R.M., *Irenaeus of Lyons*, Routledge, Oxford, 1997.
19. Migne, P.G., translation in the Ante Nicean Fathers (ANF02).
20. See Zuiddam, B.A., New perspectives on Irenaeus: Scripture as oracular standard, *Ekklesiastikos Pharos* **93**(22):288–308, 2011; Early Orthodoxy: the Scriptures in Clement of Alexandria, *Acta Patristica et Byzantina* **21**(2):257–268, 2010; Holy letters and syllables: The function and character of Biblical authority in the second century, *Dutch Reformed Theological J.* **XXXVIII**(3):180–191, September 1997. Also: Heilige Letters en Lettergrepen. *De functie en het karakter van Schriftgezag in de tweede eeuw, zoals dit naar voren komt in de werken van Ignatius van Antiochië, Irenaeus van Lyon en Clemens van Alexandrië* (Holy Letters and Syllables. The function and authority of Scripture in the second century, as represented by Ignatius, Irenaeus and Clemens of Alexandria), Importantia, Dordrecht, p. 432, 2007.
21. E.g. Brown, D., *The Da Vinci Code*, Corgi Books, London, p. 231, 2003.
22. 'Apocrypha' refers to the hidden and less obvious visibility of God's truth in these writings. In case of the Old Testament Apocrypha this was never intended to mean forbidden books that Christians should somehow stay away from. The meaning became confused as it was also applied to heretical and dubious pseudonymous Gospels and epistles from the New Testament era, like the Gnostic Thomas Gospel and Peter's Apocalypse.
23. ANF = Ante Nicean Fathers, online: www.ccel.org/ccel/schaff/anf02.toc.html.
24. See Zuiddam, B.A., Jordaan, P.J. and van Rensburg, F.J., Λόγιον in Biblical Literature and its implications for Christian Scholarship, *Acta Patristica et Byzantina* **19**:379–394, 2008.
25. See Zuiddam, B.A., Reason's dead end in David Faure: Why the Cape's earliest liberal minister embraced Spiritualism, *Luce verbi/In die Skriflig* **43**(2):271–289, 2009.

Benno Alexander Zuiddam *D.Th. (Church History) Ph.D. (Greek) studied at four universities in Europe and South Africa. He is research professor (extraordinary associate) with the Faculty of Theology of North West University, Potchefstroom, South Africa. He also serves with Greenwich School of Theology (UK) and the Centre for Patristic Research (Free University Amsterdam/ University Tilburg). Prof. Zuiddam has published in a great variety of peer-reviewed journals, including international publications in the fields of Greek and Old Testament Studies. He also authored an in-depth study on the authority of the Scriptures in the early church, as well as an introduction to the history of the Western Church. His research focuses on divine revelation in early Christian and biblical literature and the Greco-Roman world, but he also takes a professional interest in theological liberalism, particularly in the 19th century. In 2014 Prof Zuiddam was elected member of the South African Academy for Science and Art.*

Modelling biblical human population growth

Robert Carter and Chris Hardy

The Bible presents several historical scenarios in which the human population grew from very small numbers. These include the initial populating of the world starting with Adam and Eve and the repopulating of the earth from three founding couples after Noah's Flood. There were also multiple small-scale duplications of these events within the many post-Babel populations, including the growth of the Hebrew nation from Jacob and his twelve sons. Most modern commentators on the subject of biblical demographics have assumed a smooth increase in the population over time, but small populations do not tend to grow in an algebraic manner. We wanted to analyze many different biblical scenarios, so we created a population modelling program in the C# programming language that could handle multiple variables like age of maturation, minimum child spacing, and age of menopause, as well as probabilities like polygamy, twinning rates, and a variable risk of death according to age. We were able to demonstrate that the current world population and the size of the Exodus population are easy to account for under most parameter settings. The size of the antediluvian and Babel populations, however, remain unknown.

Multiple authors have written briefly about the mathematical feasibility of the demographic claims in the Bible. Most have concluded there is no biblical paradox but most have only cursorily dealt with the issues involved. Despite occasional claims from skeptics,[1] it is entirely possible to obtain significant numbers of people in short amounts of time.[2] This includes reaching the current world population of over 7 billion people in only ~4,500 years since the Flood.[3] Morris was the earliest reference we could find for someone who attempted an algebraic solution.[4] He attempted to account for generation time, family size, and longevity in his calculations but this was prior to the invention of the personal computer and he simply could not track as many variables as is possible today. Later commentators have tended to use a simple algebraic approach (see the exponential growth formula below) to answer these questions as well.

Population growth depends on a combination of birth rate and death rate and is affected by the carrying capacity of the environment. Humans, unlike other species, have the ability and intelligence to grow beyond what would otherwise be the environmental carrying capacity, witnessed by the dramatic growth of the world population in recent decades. While we do not know what environmental challenges the antediluvian and immediate post-diluvian populations faced, human populations have the ability to grow quite quickly. Based on numerous examples from recent history, we expect the early post-Creation and post-Flood generations would have experienced a rapid population increase, under a wide range of potential conditions, but what rate of growth is reasonable?

The standard exponential model of population growth is as follows:

$$N = N_0 e^{kt}$$

where N = the population size at time t, N_0 is the population size at time 0, and k = the growth rate. Importantly, this formula should only be applied to large populations. While it is true that the human population only needed to average a 0.464% growth rate (k) to go from 6 (N_0) to 7 billion (N) people in the c. 4,500 years (t) since the Flood, the growth of small populations is stochastic by nature. One reason for this is the fact that random births and deaths have a much greater effect in a population of, for example, 10 individuals than they do in a population of 10,000 individuals. Another reason is the unpredictable availability of members of the opposite sex in very small populations. Consider a biblical model starting with Adam and Eve. The population size at 100 years could be drastically different if they had children in the order boy-girl-boy-girl-boy-girl versus a scenario where they had a series of boys (or a series of girls) in the early years. Thus, it is impossible to predict or accurately model the growth of small populations with the exponential growth formula.

Modern genetic data indicate the human population has exploded over the past several thousand years.[5] But that is only considering the size of the population. In fact, excess population has had a significant factor throughout much of world history. For example, various Greek colonies were founded across the Mediterranean and Black Sea regions by young people looking for space. Likewise, the invasions of the Germanic tribes into Roman Europe in the waning years of that empire were driven in part by population expansion. And the Viking invasions across Europe several centuries later were propelled by that population's ability to raise more children than the culture could provide space for.[6] Throughout recorded human history, the rate of population growth has often been great enough to put extreme pressure on land ownership and the control of resources, sometimes

leading to mass migration, and often sparking wars. One might ask, "Given the high reproductive capacity of people, why has the population grown so slowly?" The answer is probably that most people ever born probably died of warfare (often fuelled by population excess), starvation (due to war or weather), or disease before they reached their full reproductive potential. These factors are very much dependent on population density, however, and so should have less impact when a population is small and growing.

Biblically, the entire human race descends from just two people, Adam and Eve. Growing to unknown numbers over the first one and a half millennia, the population then went through an extreme but short bottleneck when only eight people survived Noah's Flood. From the three sons of Noah (and their three wives), the population grew again to unknown numbers before being subdivided at the Tower of Babel, whereupon each of the resulting subpopulations followed an independent, and complex, growth trajectory. Those three demographic expansion events need to be addressed mathematically to see if they comport to reality. An additional population expansion mentioned in the Bible is that of the Israelites. Only a few centuries after Jacob, his twelve sons, and their children moved to Egypt,[7] several million Hebrews left at the Exodus. Some argue for a 'short' sojourn of 215 years, while others argue for a 'long' sojourn of 430 years. This is a long-standing textual debate that also influences the date of creation.[8] The large size of the Israelite population at the Exodus has been used as a critique of the short sojourn hypothesis.[9] Is this a valid critique? Can 12 adult couples produce several million people in just 215 years?

We understand that it is possible to get a large population in a short amount of time, but do all scenarios lead to such population growth? And how likely is it that the sparse biblical data actually match the historical record? We wanted to explore the demographic possibilities within each of these major biblical scenarios. To that end, we wrote a computer program that tracked as many factors as possible, including age of maturation, minimum child spacing, age of menopause, rates of polygamy, twinning rates, and a death probability based on actuarial tables. We also wanted our model to be flexible enough to examine post-Creation, post-Flood, and both the long and short Egyptian sojourn scenarios. Historically, most population models use discrete cohorts, where each generation is treated as a discrete set and removed from the population model after reproducing. This is sufficient for species with an annual life-death cycle, and works well enough for long-lived species with large population sizes, but it is not sufficient for the biblical scenarios we wanted to model. Instead, we tracked each individual separately and used probability distributions to determine their survival, marriage, and number of children. This allows for more realistic scenarios where members of different generations may mate.

Methods

We constructed a population tracking program in the C# programming language that can be used for a wide range of scenarios, including both large and small populations (up to the limits of available computer memory).[10] For each scenario modelled, we set minimum childbearing ages (CBA) for females and males. This was the age at which children were entered into the marriage pool. We also set a maximum CBA for females. We set the probability of a man getting married after passing the minimum CBA at 50% per year (6.7% per 1/10 year) if at least one lady was available. Once married, we assigned an initial annual pregnancy probability of 0.88. Children were born to each married couple with a minimum child spacing until the female reached the maximum childbearing age.

In order to approximate the risk of death, we incorporated the 2009 US actuarial tables[11] into our model. This should be sufficient for asking how the modern human population could grow from three founding couples but we modified the curve in some model runs to better reflect the biblical data. For example, since the modern life expectancy of 75–80 years is approximately 1/12th the typical lifespan of 900 years before the Flood, we multiplied the age for death probabilities at each stage by 12 while modelling the antediluvian population.

The Maximum Age parameter sets the age at which the probability of dying that year reaches 1. Due to the exponentially increasing probability of death as age increases, only a tiny fraction of the population came to within 5% of the set maximum in any model run, as with real human populations. The actuarial table we used for our model (with a maximum age of 120) is based on modern populations, in which typically the oldest person known to be alive anywhere on earth is 114 or 115. Although people in ancient populations probably suffered more early death due to disease and injury, while the elderly who avoided those risks lived longer than modern humans (at least through the Exodus), we are assuming the probability of death curve was similar then to now. In all post-Flood models reported here, we set the maximum age to 120, unless otherwise specified.

On top of the standard mortality tables, we added an extra factor to account for an increased risk of maternal mortality prior to the advent of modern medicine. Since childbirth has historically been the greatest mortality risk for women of childbearing age, we allowed a set risk of maternal mortality for each birth (double for twins), and we could modify the value as needed. We assumed that the child also died if the mother died. This parameter has some overlap with both the

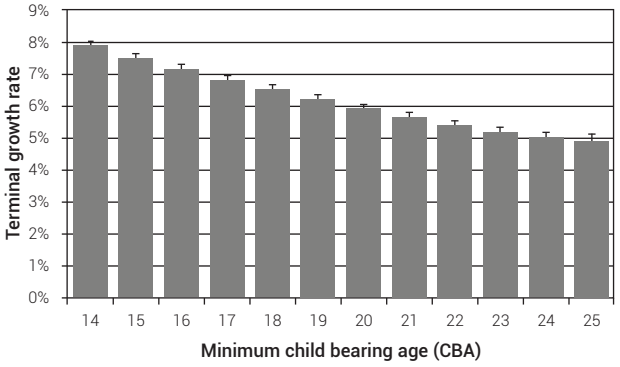


Figure 1. Terminal growth rate vs minimum CBA for a population starting with three founding couples and allowed to reproduce to at least 10,000 individuals. Minimum child spacing was set to 1 year. Maximum CBA was set to 45. Results are the average of 1,000 model runs for each parameter setting. Error bars are 1 S.D.

minimum child spacing setting and the actuarial tables, but it allowed us increased flexibility to explore various scenarios.

Since we are dealing with ancient societies, we included the ability to model the effects of polygamy (more specifically, polygyny). There exist quite a large number of possibilities, so we settled on what seemed like a reasonable scenario and built flexibility into the program so we could explore alternate scenarios if necessary. When the most generic model of polygamy was enabled, 1% of men with one wife were allowed first pick of the available females in the population. Men with two or more wives had a 5% probability of adding more. We set the maximum number of wives to 5. The remaining females were allowed to marry the remaining males at random. As always, any unmarried individuals were held over for the next round. Females who passed the maximum CBA while available were moved to the "widows" list.

When individuals were born into the population, they were assigned a birth date in tenths of years.[12] This was done as a compromise. Annual increments led to stochastic outputs or strong 'cohort' effects where multiple children were reaching maturation and marrying at the same time, creating distinct pulses of population growth through childbirth, especially in the early years of population growth. On the other hand, dividing up years into 365 increments was computational overkill.

Table 1: Modelled parameter list and the ranges used in various model runs.

Parameter	Range
Minimum childbearing age	15–30
Maximum childbearing age	30–600
Maximum individual lifespan	30–1200
Probability of maternal death	0.01–0.05
Min. years between children	1–60
Probability of twins	0.011
Probability of male child	0.51
Rate of polygyny	0-0.1

Model assumptions

Even though we attempted to be as comprehensive as possible, there were several areas where we simply had to make assumptions. For example, we assume a rate of twinning of 1 in 89 births. This ratio changes over time and across cultures[13] but since it is less than 2% of all births, it should have but a small effect on population growth. Likewise, there is no available data for ancient maternal mortality when carrying twins, and ancient mortality rates should be higher than today, so we simply doubled the set maternal mortality rate for twins. We did not even consider triplets, for they are several orders of magnitude more rare and the maternal death rates in these cases were extreme for times more than 100 years ago.

We allowed for remarriage after the death of a spouse, but only as long as the living partner was below the CBA cutoff. Even though males could theoretically father children if they were above their CBA, we simplified things by not allowing them to remarry if older than that. Once married, couples stayed married until death.

See table 1 for the adjustable parameter list.

Results

Model validation

Figures 1–3 show summary results of a simple model of population growth. Minimum child spacing was set to 1 year. Minimum CBA ranged between 14 and 25. Maximum CBA was set to 45. Maximum age was set to 120, but this parameter had little effect on the final results because very few people lived to anywhere near the maximum age. Results are the average of 1,000 model runs for each setting of CBA. Figure 1 shows the terminal growth rates (the slope of the line from each graph of population size versus time), calculated from the final order of magnitude of population growth (approximately the final 20%) of each model run.

Figure 2 shows the population structure of a model run with minimum CBA set to 14. The thin, tall peak in the chart is due to a high maximum potential age (a very few people simply lived a long time). The shape of the distribution is similar to that of a 'young' population like that of modern Nigeria.[14] When minimum CBA increases, there

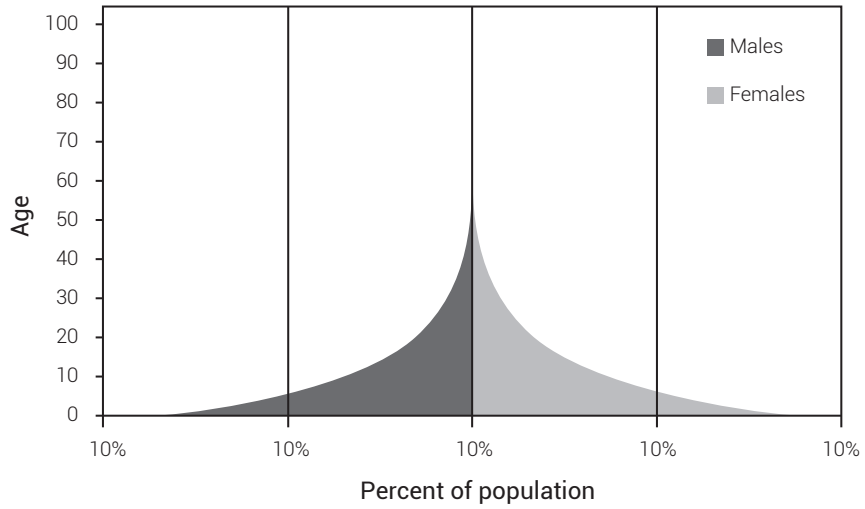


Figure 2. Population structure with a minimum CBA of 14, a maximum CBA of 45, and a minimum child spacing of 1 year (average of 1,000 model runs that ended when n >= 10,000 individuals; error bars omitted).

are proportionally fewer young individuals in the population and the pyramid has a narrower base (data not shown). When minimum CBA is set to very high values, we noticed a 'cohort' effect, where the delay in reproduction produced several waves of population growth as multiple individuals reach reproductive age simultaneously.[15] This is similar to the 'baby boom' that occurred in Western countries after World War II. These waves were due to the fact that we started with *N* couples already at reproductive age but with no children.

All modelled populations took several decades to settle down into a regular, algebraic growth phase. Most of the variability occurred when the population size was less than 100 individuals and almost all variability was evened out by the time 1,000 individuals were alive.

Figure 3 shows the percent survivorship curve for a modelled population with minimum CBA set to 14.

From the Flood to the modern population

Figure 4 displays the results of a multi-parameter model run (minimum child spacing versus minimum CBA), using modern (USA 2009) actuarial data and a post-Flood-like scenario with three founding couples. We allowed the minimum child spacing to range from 1 to 10 years and the minimum childbearing age to range from 14 to 25 years. In almost all scenarios where the population did not go extinct, the critical level of 0.464% (the rate required by the exponential model of population growth to reach seven billion people in 4,500 years from three founding couples, see above) increase per year was reached. In other words, it is trivial to obtain the current world population from three founding couples in four and a half millennia.

Impact of polygamy

In Figure 5 we show the effect of polygamy (polygyny). A small percentage of men were allowed up to a maximum of five wives (details in Methods). On average, most model runs experienced a boost of approximately 4% over baseline (i.e. they were growing at 104% the rate of a non-polygamous model with the same parameter settings). Near the edge of population survivability, polygyny enabled some populations to experience more growth, on average, due to the fact that unwed women were more rare. In other model runs (data not shown) we increased the polygamy rate up to 10%. At these extreme values, there was a much stronger effect at the margins of survivability, but this levelled off at higher growth rates. For most parameter

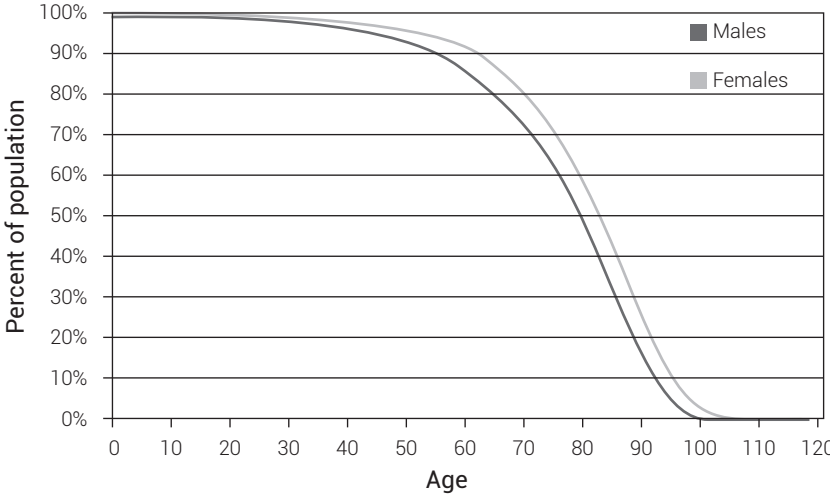


Figure 3. Percent survivorship curve with a minimum CBA of 14 and a minimum child spacing of 1 year (average of 1,000 model runs that ended when n >= 10,000 individuals; error bars omitted). These data closely parallel the 2009 US actuarial tables that were used to estimate death rates at each age.

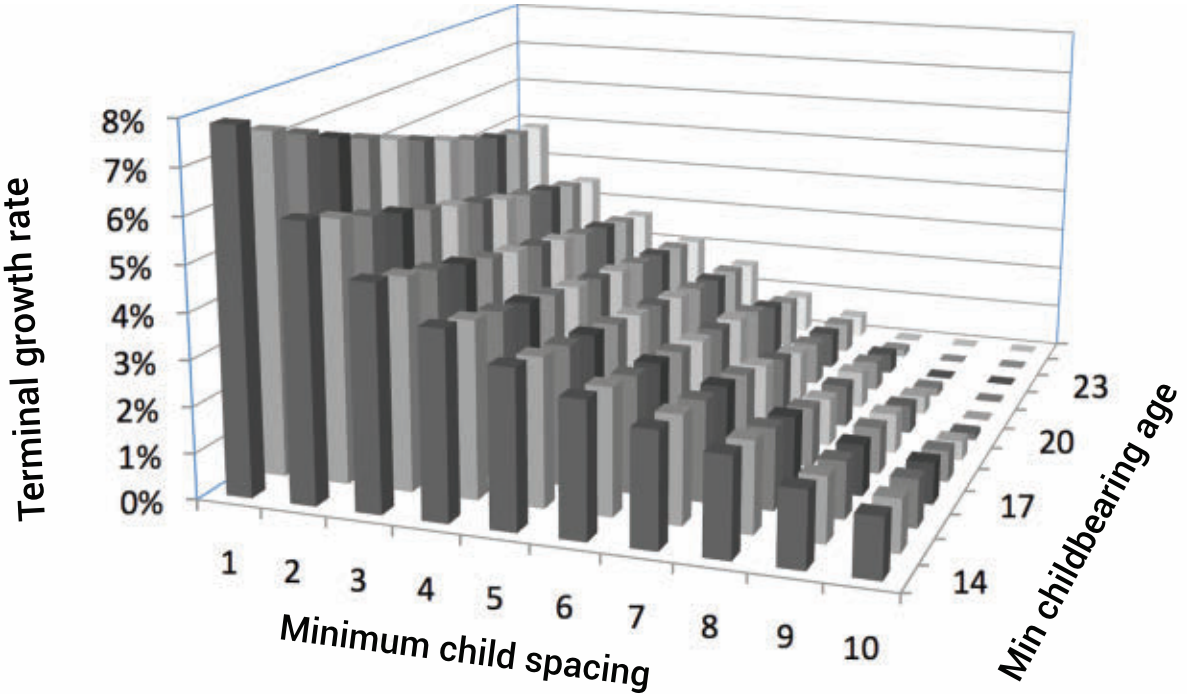


Figure 4. Terminal growth rate vs minimum child spacing and minimum CBA. Results are for 1,000 model runs at each parameter setting (error bars omitted). Each run was terminated when the population size exceeded 10,000 individuals and the growth rates were calculated from the final order of magnitude change in population size (approximately the final 20% of the data). In almost all situations, the calculated growth rate was greater than the 0.464% required to go from the three post-Flood founding couples to the current world population of 7 billion people, but note that it was entirely possible for the population to go extinct under certain parameter settings.

settings, the net effect was not more than an additional 1% increase over baseline.

The impact of very old people having children

By varying the maximum age of childbearing, it is possible to illustrate the potential impact of very old women having children. Figure 6 shows the terminal growth rates of multiple model runs. Each has a minimum CBA of 20. Maximum CBA varied from 40 to 100 in 5-year increments and the minimum spacing between children varied between 1, 2, or 3 years. Children born into smaller populations have a greater percentage impact on the future population than children born into larger populations. Therefore, the impact of increasing the years of childbearing has a diminishing effect. Here, children born when a woman was 100 years old entered a population 59, 27, and 17 times larger, respectively for the three values of minimum child spacing, than a child born when that same woman was 40.

From the Flood to the Tower of Babel

The date of the Tower of Babel event is unknown. From context, it appears the timing has something to do with a man named Peleg, whose name means 'division' (Gen 10:25).[16] He was born c. 101 years after the Flood and lived until c. 340 years after the Flood (Gen 11).[17] If the division of people occurred only 100 years after the Flood, there would not be many people in the world. However, the data behind the growth rates calculated in figure 4 indicate that under some scenarios it is possible to obtain a population size greater than 1,000 individuals in that much time. This occurred at all settings of minimum CBA with a minimum child spacing of 1 year, or with small minimum CBA and a minimum child spacing of 2 or 3 years. It is also possible to arrive at over 10,000 individuals with a minimum child spacing of 1 year and a minimum CBA <= 17, and up to 40,000 individuals with a minimum CBA of 14, although these are not likely scenarios. After 340 years, it is trivial to have 1,000 individuals in the population and most parameter settings produce population sizes many orders of magnitude greater than that. How many people were in existence when the population was divided? Sadly, one cannot determine the number from numerical analyses like these.

The Sojourn

According to Exodus 12:37–38, there were 600,000 Hebrew men in the Exodus population. Numbers 1:46 gives a more precise 603,550 men aged 20 and up. There are several ways to estimate the Exodus population size. If one

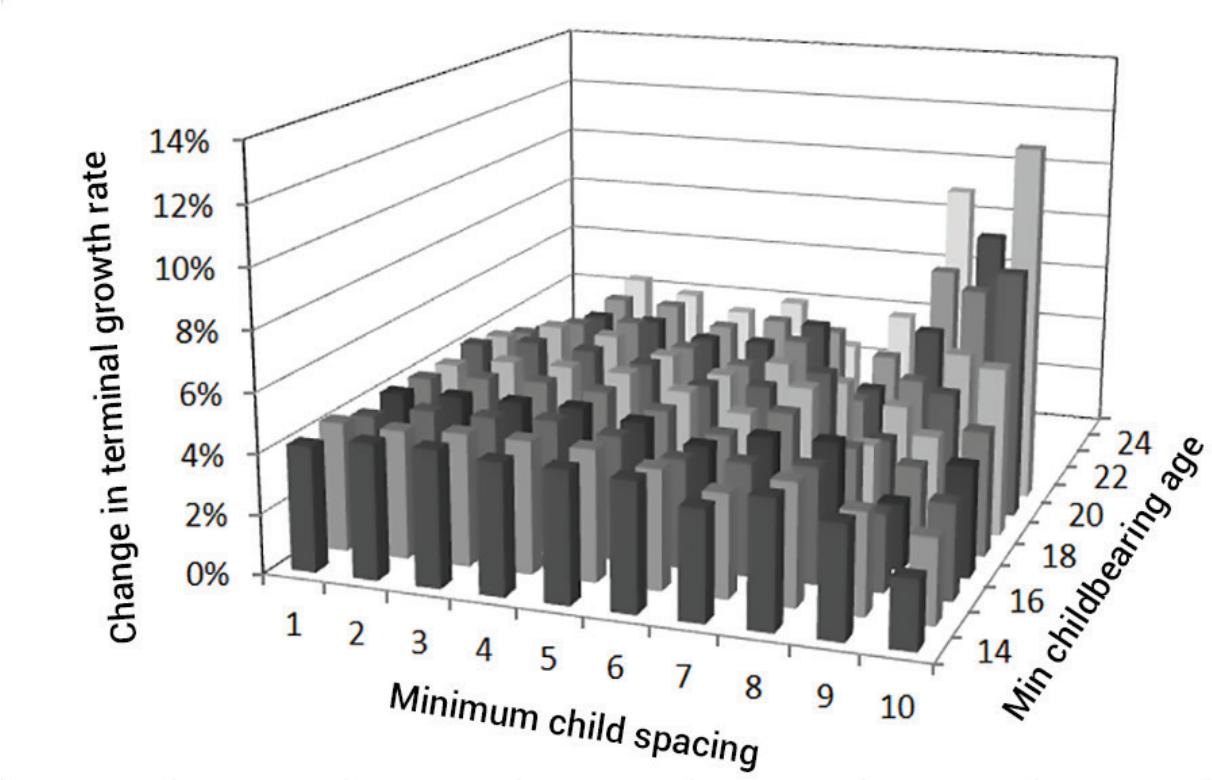


Figure 5. Effects of polygamy (polygyny) compared to the baseline (figure 4). Results are the average of 1,000 model runs at each parameter setting (error bars omitted). The impact of polygamy was noticeable but not very strong. Most model runs experienced a boost of approximately 4% over baseline (i.e. 104% the growth rate of a non-polygamous population with the same parameter settings). Near the edge of population survivability (i.e. with high CBA and large gaps between children) polygyny enabled some populations to experience more growth, on average, due to the fact that unwed women were more rare.

assumes an equal number of females and more children than adults at the Exodus, a figure of 2.7 million is a good approximation. Starting with 12 founding couples, it was possible to reach 2.7 million people within the 215-year 'short' sojourn model, but only under certain, favourable parameter settings (figure 7).

In the 430-year 'long' sojourn model, reaching a population size of 2.7 million was trivial (figure 8). Of course, the final population sizes we are reporting here are unrealistic. Environmental restraints would take over long before these extreme population sizes were reached.

The antediluvian population size

We modelled various scenarios that started with a single founding couple. As before, it was simple to obtain significant numbers in a short amount of time. However, we know very little about the age of maturation (minimum CBA), minimum or average child spacing, etc., of antediluvian women. Therefore, there are too many unknown variables and there is no way to estimate the antediluvian population size. It could have been in the billions. Or it could have been a few thousand. We cannot know.

Discussion

Using realistic demographic parameters, all modelled populations experienced rapid growth, on average. It was entirely possible to drive a population to extinction, however. As the average number of children per female approached the 'replacement value', more simulation samples resulted in extinction. When the minimum CBA and child spacing was such that women could have more than two children only by bearing twins, all samples went extinct. The exact replacement value depends on many factors. Essentially, it is the number of children each female must have in order to guarantee that at least one female child reaches adulthood, on average. The number is often cited as '2.1', but it is less than that in Western cultures and often much greater than that in developing countries.[18] We included parameter settings that led to extinction in figures 4 and 5 to illustrate this.

There are two main factors that influence population growth the most: minimum CBA and minimum child spacing. This makes sense in that a population will grow most quickly when people marry young and have children close together. This also means, however, that the maximum CBA is far less relevant. Furthermore, since the

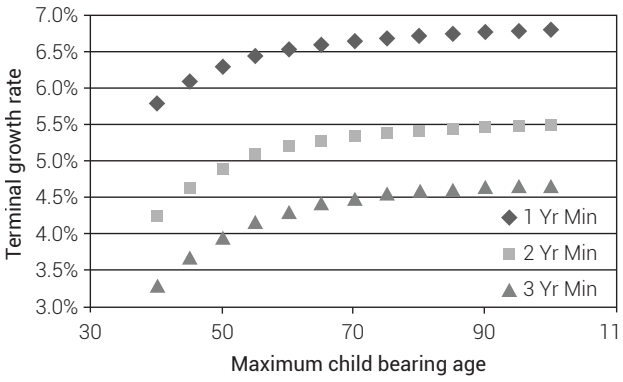


Figure 6. Terminal growth rate vs maximum childbearing age for three levels of minimum child spacing. In all cases, the minimum CBA was set to 20, meaning the span of childbearing ranged from 20 to 80 years. Increasing the range of childbearing by allowing older women to have children has a diminishing effect on the population growth rate, as expected. Therefore, if the biblical Patriarchs (and their wives) lived to very old age, and had children at a great age, this would have little impact on the growth rate of the population.

people who reproduce earliest will have a higher percent representation in the future population, genetics should be driving all populations towards faster reproduction, by default. Early maturation is thus a mathematical certainty, given a population with individuals that have a range of maturation ages. This alone could explain the population-wide drop-off in lifespan after the Flood. While it is true that individual mutation count should increase over time, contributing to a decline in lifespan,[19] it is also true that the ones who reproduce the fastest will outnumber those who do not. In the end, maximum lifespan does not matter. This comes into sharp focus when considering modern cultures. For many reasons, people in wealthier 'First World' nations are tending to have less children, farther apart, and with a delayed start of childbearing. And, while China and India have huge populations, their growth is levelling off, while the population of Africa is still increasing rapidly. Life expectancy is generally higher in the slowest-growing populations.

It is not necessary to model the great ages of the biblical Patriarchs, or the fact that their ages decreased over time, because children born to these people late in life are almost irrelevant as far as their impact on future population growth is concerned. The future impact on the population size caused by the birth of any specific individual is simply the inverse of the population size at that time. In fact, the relative individual impact on the future population size of any two people is simply the ratio of inverse population sizes when each person was born, which can be reduced to a simple ratio of the relative times when they were born:

$$(1/N_0e^{kt1}) / (1/N_0e^{kt2}) = t_2/t_1$$

The only caveat is that people who lived a long time may not have matured as young as modern people, so the minimum CBA might come into play to a greater degree than we illustrate here. Yet, the average generation span for the first seven generations born after the Flood is 31.4 years, and there is no reason to suspect these are all oldest children.[20] Interestingly, the modern average human generation time is approximately 30 years.[21]

This brings up another interesting point; kingship has historically been conferred on the eldest sons. Thus, one might expect a long line of kings to experience more generations on average per century than the rest of the population. Thus, when Jacob met Pharaoh, he asked him how old he was, as if he was surprised to have met such an old man (Gen 47:8). Jacob was but 12 generations removed from Noah and was the grandson of Abraham, who had met another Pharaoh approximately 200 years earlier. How many generations after the Flood was the Pharaoh of Jacob's day, and how many generations was he removed from the Pharaoh who knew Abraham two centuries prior?

The subject of how many generations removed were the modelled people from the starting ancestors is fascinating. We included this calculation for the sake of curiosity. In each run, there were always people with very long lines going back to the founding couple (essentially equal to the length of run/minimum CBA) and at the same time people with very short lines in their family tree (due to the fact that very old men could still father children with younger wives). There are modern analogues to the Abraham-Pharaoh scenario,[22] so this should really be no surprise.

Concerning the Egyptian sojourn, we started with 12 couples with no children, but Gen 46:27 indicates that Jacob's

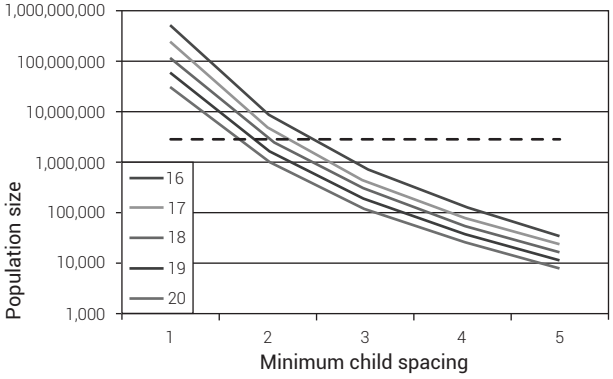


Figure 7. Population size vs minimum child spacing for five settings of minimum CBA (legend) in the short sojourn model. Starting with 12 founding couples, it was possible to reach the required estimate of 2.7 million Hebrews in 215 years (any place where the graphed lines are higer than the 2.7 million cutoff line), but only under certain favourable parameter settings (minimum child spacing had to be < 3 in all cases and < 2 in some cases). Note that environmental limitations would have prevented the population from reaching the largest projected sizes.

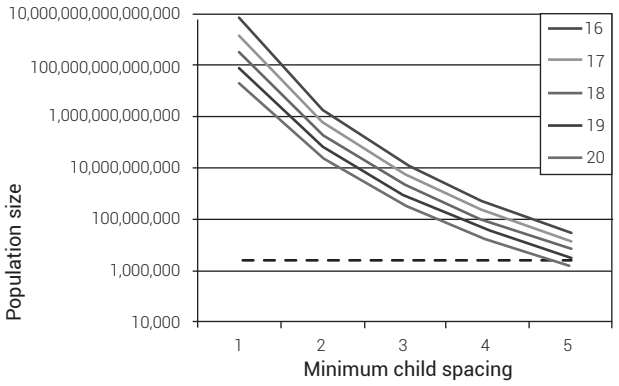


Figure 8. Population size vs minimum child spacing for five settings of minimum CBA (legend) in the long sojourn model. Starting with 12 founding couples, it was possible to reach the required estimate of 2.7 million Hebrews in 430 years under almost all parameter settings, but note that environmental limitations would have prevented the population from reaching the majority of these projected sizes.

sons had already started reproducing before he moved to Egypt. In other words, the clock started *before* they arrived in Egypt and the 215-year sojourn is a minimum figure. Adding more individuals to the starting population size makes it easier to arrive at the required Exodus population size then we report here.

Also, Jacob brought household servants with him to Egypt (Gen 12:16, Gen 14:14, and *cf.* Gen 46:1 "all that he had"), who might have occasionally married into the family. This is especially true of the women, but the male servants were also circumcised (Gen 17:13), meaning they were at least tangentially part of the Covenant. Could long-standing, multigenerational, faithful, God-fearing, male family servants have married into the family as time progressed? This is likely, especially since many of them would eventually have Jacob as an ancestor, for obvious reasons.

In conclusion, it is relatively easy to explain the modern world population, starting with the six Flood survivors, in c. 4,500 years. The number of people alive at the Tower of Babel event is more difficult to determine, but could easily have been in the thousands, or even tens of thousands, under certain conditions. The long/short sojourn debate cannot be answered with demographic data, but there is no reason to reject the short sojourn from numerical data alone. And, it is impossible to estimate the number of people alive at the Flood, for we simply do not have the necessary demographic data.

References

1. E.g., Repopulation after the Flood, talkorigins.org/origins/postmonth/may04.html.
2. Morris, H., How Populations Grow, undated; icr.org/article/18555.
3. Batten, D., Where are all the people? *Creation* **23**(3):52–55, 2001; creation.com/where-are-all-the-people.
4. Morris, H.M., World population and Bible chronology, *Creation Research Society Quarterly* **3**(3):7–10, 1966.
5. Keinan, A. and Clark, A.G., Recent explosive human population growth has resulted in an excess of rare genetic variants, *Science* **336**:740–743, 2012.
6. Cunliffe, B., Europe Between the Oceans: 9000 BC–AD 1000, Yale University Press, 2008.
7. Carter, R.W., Inbreeding and the origin of races, *J. Creation* **27**(3):8–10, 2013.
8. Hardy, C. and Carter, R., The biblical minimum and maximum age of the earth, *J. Creation* **28**(2):89–96, 2014.
9. E.g. Minge, B., 'Short' sojourn comes up short, *J. Creation* **21**(3):62–64, 2007.
10. Copies available upon request. Send an email to us@creation.info.
11. Actuarial tables courtesy of the US Social Security Administration: ssa.gov/oact/STATS/table4c6.html.
12. See also the discussion of 'date slippage' in Hardy and Carter, ref. 8.
13. Pison, G. and D'Addato, A.V., Frequency of Twin Births in Developed Countries. *Twin Research and Human Genetics* **9**(2):250–259, 2006; epc2006.princeton.edu/papers/60568.
14. populationpyramid.net/nigeria/.
15. These can be reproduced easily by interested parties using the original program.
16. Sarfati, J., 'In Peleg's days, the earth was divided': What does this mean? 3 Nov 2007; creation.com/in-pelegs-days-the-earth-was-divided.
17. For a discussion of the ambiguities associated with these dates, see Hardy and Carter, ref. 8.
18. Espenshade, T.J., Guzman, J.C. and Westoff, C.F., The surprising global variation in replacement fertility, *Population Research and Policy Review* **22**(5–6):575–583, 2003.
19. Wieland, C., Decreased lifespans: Have we been looking in the right place? *J. Creation* **8**(2):138–141, 1994.
20. Carter, R., How old was Cain when he killed Abel? *Creation* **36**(2):16–17, 2014.
21. Langergraber, K.E., *et al.*, Generation times in wild chimpanzees and gorillas suggest earlier divergence times in great ape and human evolution, *PNAS* **109**(39):15716–15721, 2012.
22. An example would be the two currently living grandchildren of John Tyler, who was born in 1790 when George Washington was President, and who was himself U.S. President 1841–1845; *cf.* wikipedia.org/wiki/John_Tyler.

Robert Carter *received his B.Sc. in applied biology from the Georgia Institute of Technology in 1992 and his Ph.D. in coral reef ecology from the University of Miami in 2003. He has studied the genetics of fluorescent proteins in corals and sea anemones and holds one patent on a particular fluorescent protein gene. His current research involves looking for genetic patterns in the human genome and the development of a biblical model of human genetic history. He works as a speaker and scientist at CMI-US.*

Chris Hardy *earned a B.Sc. in electrical engineering from Georgia Institute of Technology in 1994 and professionally has been programming industrial control systems since 1991. He has been studying the Bible and the evidences for creation from middle school onward, and rejected the long age 'gap theory' for a literal, historical interpretation of Genesis in high school.*

Phytogeography and zoogeography—rafting vs continental drift

Dominic Statham

Evolutionists have great difficulties explaining the global distributions of plants and animals. Accepted models of continental drift are inadequate to explain both trans-Atlantic and trans-Pacific disjunctions. At the same time, evolutionary biogeographers are unable to provide an adequate mechanism by which these distribution patterns could have arisen by dispersal. In contrast, the data fit well within a creationist model where plants and animals were rafted to the places they now inhabit on log mats left over from the Genesis Flood. The more raftable animals tend to have the most numerous transoceanic disjunctions and areas of high endemism/biodiversity tend to be concentrated in coastal regions where ocean currents intersect with land masses. Areas of high plant endemism/biodiversity often coincide with areas of high animal endemism/biodiversity, suggesting that the plants and animals were transported to these places by the same means.

> "The pattern of geographical distribution [of plants and animals] is just what you would expect if evolution had happened." (Richard Dawkins, Oxford University[1])
>
> "Biogeography (or geographical distribution of organisms) has not been shown to be evidence for or against [macro] evolution in any sense." (Gareth Nelson and Norman Platnick, American Museum of Natural History[2])

Disjunct distributions, where similar plants and animals are found in widely separated areas, are numerous. Moreover, many patterns of disjunction are seen, giving rise to the concept of 'tracks of dispersal' (figure 1). In the preface to their *Cladistic Biogeography*, Humphries and Parenti argue that "These 'generalised tracks' of distribution are so consistent in disjunct, transoceanic terrestrial taxa ... that they imply historical connections between the biotas."[3] Many of these 'historical connections', it is argued, can be explained by continental drift and the associated fragmentation of widespread ancestral species.

Among geologists, the generally accepted model has the supercontinent Gondwana rifting to form the Atlantic Ocean, with Africa splitting off from South America about 120 Ma ago. This, however, is poorly supported by biogeographic data. Of about 200 seed plant families native to eastern South America, only 156 are common to eastern South America and West Africa, whereas 174 are common to eastern South America and eastern Asia.[5] This hardly fits the view that, prior to the rifting of Gondwana, South America and Africa were joined for millions of years. Moreover, hundreds of plants found in both South America and Africa are classified as being the same species. How, then, can they have been separated for over a hundred million years? Given the alleged power of evolution, it would seem remarkable that they haven't changed significantly over such a long period of time. Furthermore, according to evolution theory, many plants and animals with transoceanic disjunct distributions originated millions of years *after* the continents are said to have drifted apart.[6–11]

In order to explain the hundreds of trans-Pacific disjunctions, some biogeographers have rejected the geologists' model of Gondwana rifting to form the Atlantic Ocean, in favour of an alternative supercontinent, Pacifica, rifting to form the Pacific Ocean.[12] Another scenario proposed to explain transoceanic disjunctions is the 'Expanding Earth' hypothesis. This postulates that, prior to the Jurassic period, the Earth was smaller with all its present oceans closed and that an increase in Earth's radius gave rise to both the Pacific and Atlantic Oceans.[13,14]

Further confusion about Earth's geological history arises from the many anti-tropical distributions where plants and animals are disjunct across the tropics, i.e. they are found in the northern and southern regions but not in between.[15] This has led some evolutionists to postulate a pre-Pangaean configuration whereby the present northern and southern regions were once adjacent to one another.[16] As admitted by Van Damme and Sinev: "None of the theories can reconcile the current geological and biogeographical data."[17]

The difficulties evolutionists have in explaining biogeographic patterns have led to the most remarkable admissions. Nelson and Platnick wrote of how biogeography lends itself "to ever more complicated treatment in the abstract, which is apt to border even on the miraculous, but which is apt to crumble in confrontation with concrete facts of life". Similarly, Croizat opined:

> "... contemporary zoogeographers founder in a self-created morass of chance hops; great capacities for, or mysterious means of, dispersal; rare accidents

of over-sea transportation; small probabilities that with time become certainties; and other pseudo-explanations."[18]

The 1998 biogeography symposium of the Willi Hennig Society argued that "historical biogeography was in a mess, a subject looking for a method".[19] Writing prior to the general acceptance of plate tectonics, Darlington commented: "I have tried ... to see if I can find any real signs of [continental] drift in the present distribution of animals. I can find none."[20]

The logical alternative—dispersal

Despite their inability to correlate biogeographic data with their beliefs about Earth history, evolutionists often reject the alternative of dispersal across oceans. This is because it "is thought to be a random process, and hence it could not have given rise to the type of congruent or concordant patterns found in so many different groups."[21] Had these biogeographers believed what the Bible teaches about Earth history, however, they might have been more open-minded. The Genesis Flood would have uprooted billions of trees, many of which would have been left floating upon the oceans. These massive islands of vegetation could have easily dispersed both plants and animals around and across oceans, especially given the high levels of rainfall arising from the warm post-Flood oceans.[22] Moreover, their being propelled by ocean currents would explain the consistency of the many clear patterns of disjunction (figure 1) and the general correspondence between areas of high biodiversity and the intersection of ocean currents with land masses (figure 15).[23] Ironically, in discussing Croizat's tracks of dispersal, Humphries and Parenti remark:

"Characteristically, many disjunct patterns spanned ocean bottoms, to the point that the oceans have been characterized as the natural biogeographic regions and the continents represent the land areas around the periphery."[24]

Rafting of animals?

In discussing the plausibility of reptiles and mammals traversing significant stretches of water, it should be remembered that the safe arrival of just one pregnant female would be sufficient to establish a new colony. Moreover, there are numerous examples of sizeable islands of vegetation being seen adrift at sea.[25,26] Charles Lyell reported that rafts had been seen floating on the Amazon carrying snakes, alligators, monkeys, and squirrels and that, on one occasion, four pumas had rafted down the Parana River to Montevideo where they were discovered prowling the streets![27] Alfred Wallace records that a large boa constrictor floated 320 km (200 miles) from the island of Trinidad to the island of St Vincent, wrapped around the trunk of a cedar tree.[28] Another account involved a pirate who, having been marooned on a riverbank in hostile territory, swam to a floating nipa palm island and remained adrift for several days subsisting on the palm fruits.[29] Following the Indian Ocean tsunami of 2004, a man survived being swept out to sea for eight days, clinging to a floating tree and drinking rainwater. He was picked by a passing ship 160 km (100 miles) offshore.[30] One raft was spotted in the Atlantic, intact with trees 9 m (30 feet) high, despite having rafted along the coast of North America for over 1,600 km (1,000 miles).[31] Schuchert records how one such raft was seen carrying live lizards, snakes, and small mammals as far as 1,600 km (1,000 miles) out to sea.[32] Moreover, rafts left over from the Genesis Flood would surely have dwarfed such as these.

Woodmorappe[33] has documented how rough waters tend to concentrate rather than disperse natural rafts, with vegetation debris tending to be rolled into tight clumps. He also discusses another major source of flotsam, i.e. pumice. This is known to cover large areas—with a thickness sufficient for a man to walk on[34]—and can float in the ocean for years. The considerable volcanic activity occurring during the Flood may have produced islands of pumice thousands of square metres in area.

Zoogeography provides an opportunity to test the hypothesis that rafting played a significant role in dispersing plants and animals to their present habitats. Particularly, we would expect to see a correlation between raftability and frequency of transoceanic disjunction, with more raftable animals having a higher incidence of disjunction.

Small animals

Samples of flotsam have been found to be remarkably rich in insects and other small animals including snails, spiders, mites, millipedes, isopods, worms, and pseudoscorpions.[35,36] Numerous insect disjunctions are known across both the Pacific and Atlantic Oceans.[37–39] Although it might be argued that flying species could have been dispersed by wind, examples are also known in flightless insects such as the cricket subfamily Macropathinae[40] and the flea subfamily Stephanocircinae.[41] In addition, many transoceanic disjunctions are known among arachnids, (e.g. Micropholcommatidae (figure 2), Pettalidae (figure 3), Neogoveidae, *Mecysmaucheniidae,* Palpimanidae, Archaeidae, Chthoniidae, Tridenchthoniidae, Garypidae, Zalmoxidae and Olpiidae), millipedes (e.g. Heterochordeumatoidea, Spirostreptidae, Iulomorphidae, Cambalidae, Spirobolellidae, Rhinocricidae, Stemmiulidae, Siphoniulidae, Siphonotidae, Pygrodesmidae, Platyrhacidae,

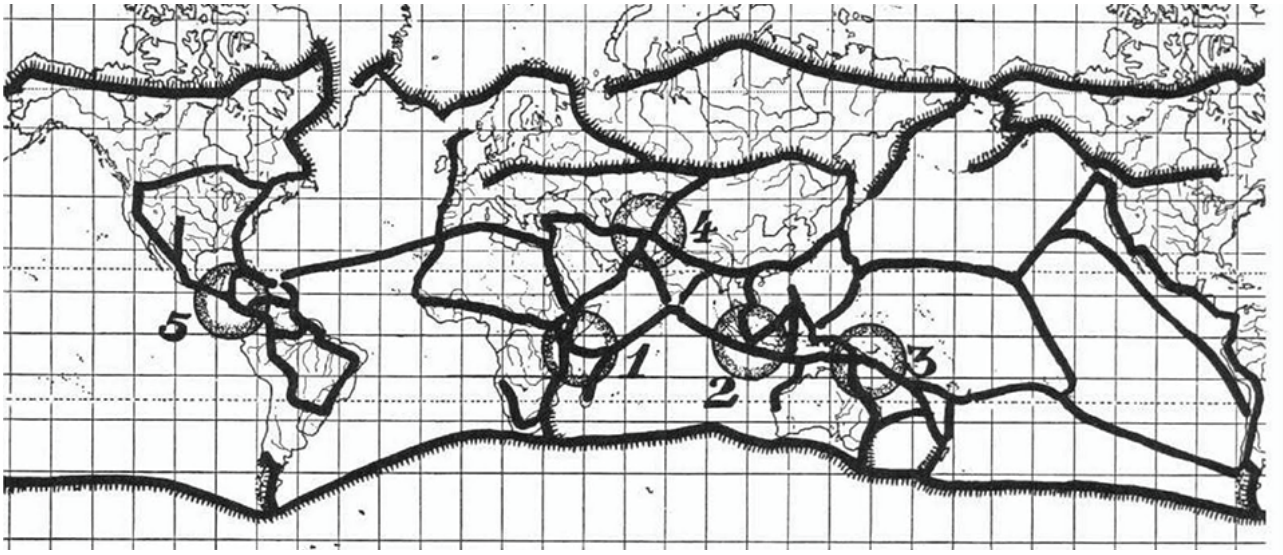


Figure 1. Léon Croizat's generalised tracks of plant dispersal. Numbered circles refer to 'nodes' of dispersal.[4]

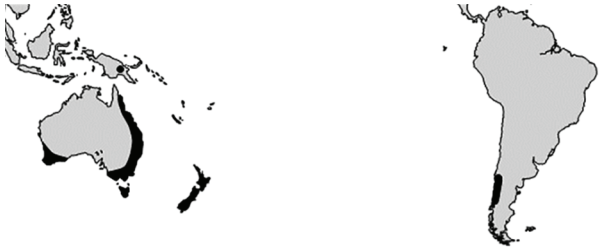


Figure 2. Distribution of micropholcommatid spiders (family Micropholcommatidae).[43]

Fuhrmannodesmidae and Cryptodesmidae),[42] planarians, earthworms and snails.[17]

Reptiles

Reptiles are among the most raftable animals due to their tolerance of salt water and their ability to subsist for long periods without eating or drinking.[45] The ability of reptiles to traverse wide stretches of ocean is illustrated by the presence of Scincidae on many islands in the western Pacific and by the gecko species, *Nactus pelagicus* and *Gehyra vorax,* both of which are distributed throughout many islands in the southern Pacific.[46]

Reptiles, generally, are widely distributed with many transoceanic disjunctions. Examples include side-necked turtles of the family Chelidae (figure 4), turtles of the family Geoemydidae (figure 5), skinks of the family Scincidae (figure 6), lizards of the family Ignuanidae (figure 7), turtles of the family Podocnemididae (figure 8), and boine snakes of the family Colubridae (figure 9). Other transoceanic reptile disjunctions include Pelomedusidae, Geoemydidae, Emydidae, Testudinidae, Crocodylinae, Amphisbaenidae, Aniliidae, Anguidae, Alligatoridae, Dibamidae, Mabuyinae, Testudinidae, Typhlopidae, Trionychidae, Leptotyphlopidae, Crotalinae, and Gekkonidae. The lizard genus *Sphenodon* is found in New Zealand and the gecko *Tarentola* made its way 6,000 km from North Africa to Cuba.[47]

Amphibians

Amphibians are less raftable than reptiles due to their lower tolerance of salt water. However there is little doubt that rafting of some amphibian groups is possible due to the presence of frogs on a significant number of oceanic islands. (It would seem that rafting provides the only viable explanation for their distribution).[56] There are fewer transoceanic disjunctions involving amphibians than reptiles but there are some, including Microhylinae (figure 10), Pipidae (figure 11), Leptodactylidae and Leiopelmatidae, all of which are anurans.[57] The pelodryadine hylids of Australia and New Guinea are closely related to a group of hyloids that exists only in South America. Even evolutionists have concluded that these must have crossed the Pacific as, in their thinking, pelodryadine hylids evolved tens of millions of

Figure 3. Distribution of the harvestmen family Pettalidae.[44]

Figure 4. Distribution of Austro-South American side-necked turtles (family Chelidae).[48]

years after the alleged Antarctic land bridge between South America and Australia disappeared.[58]

There are fewer transoceanic disjunctions involving caecilians (figure 12) and they are conspicuous by their absence in Australasia. Arguably, there are none involving urodeles (figure 13) as these may have dispersed across a warm Bering land bridge.[59,60] Giant salamanders (Crytobranchdae), for example, are found in eastern Asia and eastern North America and may have been part of a continuous plant and animal distribution linking these two regions.[61] Whereas there are numerous reptiles found on Madagascar (geckos, chameleons, skinks, iguanids, snakes, turtles and tortoises, and crocodiles) the amphibians comprise just four frog families.

The ability of relatively salt-intolerant amphibians to raft significant distances can be explained by the likely size of the post-Flood vegetation mats and high levels of post-Flood rainfall.[22] There are a number of possible explanations for the greater raftability of anurans compared with urodeles. Anuran larvae are usually omnivorous and many will eat the eggs of their own species; urodele larvae are only carnivorous.[62] Also, fewer urodeles exhibit salt tolerance than anurans.[63] One anuran species, *Fejervarya cancrivora,* is particularly salt tolerant and is known to live in brackish environments such as mangrove swamps. It also swims happily in full-strength sea water.[64] Platymantine frogs, which are widely distributed from the Philippines to Fiji, lay terrestrial eggs and forego the tadpole stage, giving them a greater chance of rafting across salt water. Arboreal anurans do not require large amounts of water and could have sheltered in upright trees, well away from sea water. The fossorial nature of caecilians would make them less likely to be found on rafts than anurans.

Mammals

Mammals are among the least raftable of terrestrial animals as they require substantial amounts of water to survive even for short periods. However, some can obtain the water they need from vegetation. Rodents are a well-known

Figure 5. Distribution of the turtle family Geoemydidae.[49]

Figure 6. Distribution of skinks (family Scincidae).[50] Some of the most closely related species are found in South America and Africa, indicating that the trans-Atlantic disjunction did not arise due to migration across a Bering land bridge.[51] The data are also poorly explained by the rifting of Gondwana as it would seem most unlikely that species would change so little over the 120 Ma since South America allegedly split from Africa.[52]

Figure 7. Distribution of the lizard family Iguanidae.[53]

Figure 8. Distribution of the turtle family Podocnemididae.[54]

Figure 9. Distribution of boa snakes of the subfamily Boinae.[55]

Figure 10. Distribution of microhylid frogs of the subfamily Microhylinae.[65]

example of this and are found on many isolated oceanic islands.[71] The few transoceanic mammal disjunctions include monkeys,[72] rodents,[73] the bat families Molossidae and Emballonuridae (all of which are disjunct across the Atlantic) and the bat superfamily Noctilionoidea which is disjunct across the Pacific.[74] Another interesting example is the marsupial *Dromiciops* found in Chile but which is more closely related to Australian marsupials than other South American marsupials.[75] The other South American marsupials probably arrived by migration from Asia across a Bering land bridge.[23,59]

More evidence of rafting from the Madagascan fauna

Evolutionists' models of continental drift show Madagascar becoming separated from the mainland in the Late Cretaceous. However, its Cretaceous vertebrate fossil record bears little resemblance to its living species. According to Angelica Crottini *et al.*:

> "The Cretaceous fauna included lungfishes, gars, nonranoid giant rogs, dinosaurs and marsupial and gondwanatherian mammals whereas the extant vertebrate fauna is composed of mainly percomorph freshwater fishes, ranoid frogs, modern squamate reptiles, lemurs, rodents, carnivores, afrotherian mammals, bats, and numerous families of birds."[76]

Figure 11. Distribution of pipid frogs (family Pipidae).[66]

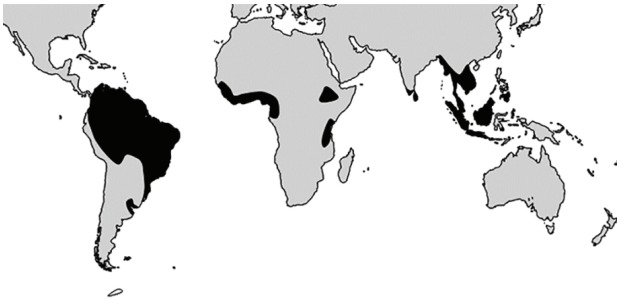


Figure 12. Distribution of caecilians.[67,68]

Figure 13. Distribution of urodeles (salamanders and newts).[69,70]

Prior to the breakup of Gondwana, Madagascar was supposedly sandwiched between India and Africa, allowing faunal interchange between South America, Africa, Madagascar and India (figure 14). This is said to explain why the lizard family Iguanidae (figure 7), the turtle family Podocnemidae (figure 8) and the boa subfamily Boinae (figure 9) are found in both South America and Madagascar. However, there are no living representatives of these groups in either Africa or India. Moreover, evolutionists' DNA analyses are said to show that their ancestors became separated about 80 Ma ago; but this is over 20 Ma *after* continental drift allegedly broke the land connection between Madagascar and South America. In an attempt to solve this problem, some have suggested that land bridges existed between Madagascar and Antarctica up until the Late Cretaceous, enabling faunal interchange between

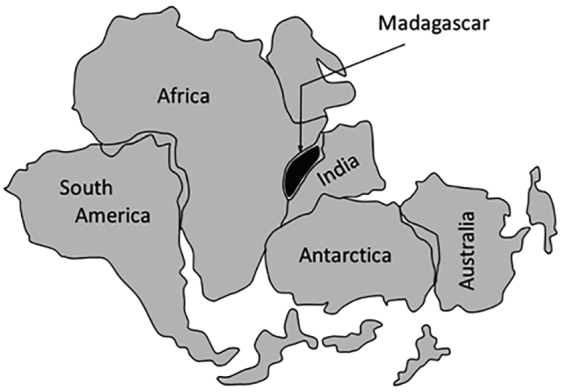


Figure 14. Madagascar's position in the hypothetical supercontinent Gondwana.

Madagascar and South America via Antarctica.[77] Others, however, are adamant that such land bridges did not exist![78,79] Similarly, Madagascan net-winged midges of the subfamily Edwardsininiae are absent in both Africa and India, but are found in South America and Australia.

Madagascar supposedly remained in contact with India for 50 Ma after it was separated from Africa but the Madagascan termite fauna is more closely related to that of Africa than India.[80] Darlington observes:

> "The Madagascan fauna ... seems to be an accumulation of animals received from two directions [Africa and the Orient] ... rather than part of a fauna exchanged by Africa and India across Madagascar."[81]

Unsurprisingly, some evolutionists concede that much of Madagascar's extant terrestrial fauna probably colonised the island by rafting.[82,83]

Areas of endemism/high biodiversity

Plants and animals are not distributed randomly. Instead they tend to be clustered in 'areas of high endemism' (regions where there are a high number of endemic species) or 'areas of high biodiversity' (regions where there are many different species but which may not necessarily be endemic). Significantly, areas of high endemism tend to coincide with areas of high biodiversity and these are often coastal areas or islands where land masses intersect with ocean currents (figure 15).

Generally, areas of high plant endemism correspond to areas of high animal endemism.[84] For example, the Yucatan peninsula of Central America is an area of endemism for amphibians, reptiles and birds. It is also one of Croizat's nodes of plant dispersal (figure 1). Madagascar is an area of endemism for reptiles, birds and mammals. This is also

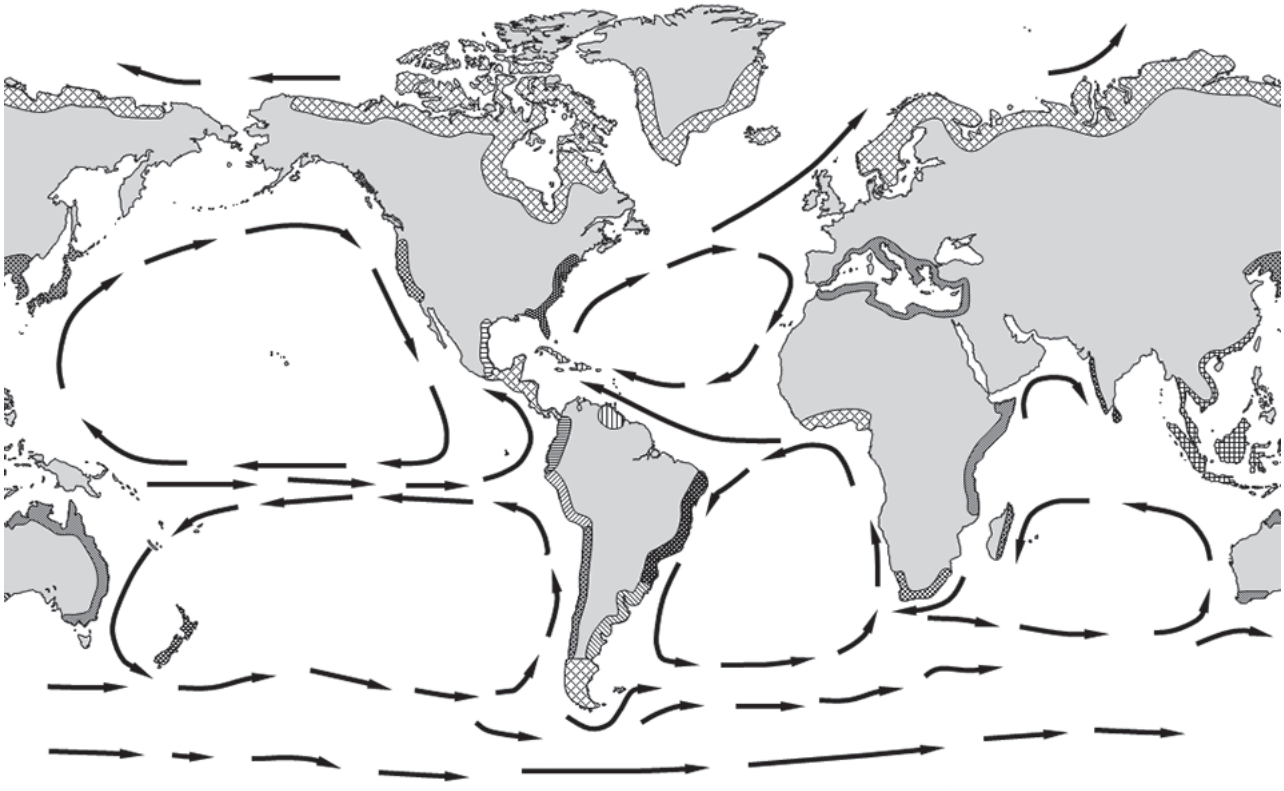


Figure 15. Areas of high endemism/high biodiversity and ocean currents.[91,92]

another of Croizat's nodes. The southern tip of South Africa is an area of endemism for amphibians, mammals and birds. It is also a point on Croizat's southern track. Another area of high plant endemism is southern West Africa (Ghana and the Ivory Coast). This is also an area of endemism for amphibians, birds and mammals.[85] As with areas of endemism generally, all these are regions where ocean currents might deposit rafts (figure 15).

Evolutionists, of course, will argue that high endemism would arise on islands and in coastal areas where there are many different ecological niches and therefore ideal conditions for evolutionary diversification. Moreover, these tend to be associated with areas of high rainfall, which might be argued to provide an environment where plants can thrive and many different plants and animals could evolve. However, this does not explain the many *patterns of disjunction* where the same plants and animals are found in the same widely separated areas of endemism.[86] This is better explained by rafting and the creationists' model of rapid post-Flood speciation.[87,88] Rafting on ocean currents would transport the same plants and animals to the same widely separated regions. These would then diversify into many different species as they adapted to their new environments, giving rise to areas of high endemism. Hence, the creation model would also predict that coastal regions and islands such as Madagascar would have many endemic species.

Conclusion

Evolutionists often present an allegedly unifying theory of Earth history, claiming that the distributions of plants and animals fit well with the geologists' model of slow continental drift and the rifting of Gondwana to form the Atlantic Ocean. The reality, however, is that the distributions of many plants and animals fit very poorly within this framework. At the same time, they support the rafting model well. There appears to be a clear association between raftability and frequency of transoceanic disjunction. Areas of high biodiversity/high endemism, generally, are found where ocean currents intersect with land masses and, most significantly, these areas often overlap for plants and animals, supporting the view that they were transported to these places by the same means. The creationist rafting model appears much superior to the evolutionist model of continental drift.

Rafting is just one of a number of means by which plants and animals could have dispersed following the Genesis Flood, other possibilities being land bridges that have subsequently fallen below sea level and transport by man.[89,90] Catastrophic plate tectonics, however, is not considered as the movement of the continents would have taken place beneath the Flood waters. The study of biogeography together with the rafting model—if deemed valid— may have implications for the ongoing debate regarding the placement of the Flood/post-Flood boundary.

References

1. Global Atheist Convention, Melbourne, Australia, 2010.
2. Nelson, G. and Platnick, N., *Systematics and Biogeography: Cladistics and Vicariance*, Columbia University Press, New York, p. 223, 1981.
3. Humphries, C.J. and Parenti, L.R., *Cladistic Biogeography,* 2nd edn, Oxford University Press, 1999.
4. Croizat, L., *Panbiogeography*, vols 1, 2A and 2B, self-published, 1958.
5. Thorne, R.F., *Floristic Relationships Between Tropical Africa and Tropical America,* Smithsonian Press, 1973.
6. Davis, C.C., Laurasian migration explains Gondwanan disjunctions: Evidence from Malpighiaceae, *PNAS* **99**(10):6833–6837.
7. De Queiroz, A., *The Monkey's Voyage*, Basic Books, New York, p. 295, 2014.
8. De Queiroz, A., The resurrection of oceanic dispersal in historical biogeography, *Trends in Ecology and Evolution* **20**(2): 68–73, February 2005 |doi: 10.1016/j.tree.2004.11.006
9. Vidal, N. *et al*., Origin of tropical American burrowing reptiles by transatlantic rafting, *Biology Letters* **4**(1):115–118, 23 February 2008 |doi: 10.1098/rsbl.2007.0531
10. Vidal, N. *et al.*, Blindsnake evolutionary tree reveals long history on Gondwana, *Biology Letters* rsbl20100220, 31 March 2010 | doi: 10.1098/rsbl.2010.0220
11. George, W. and Lavocat, R. (Eds), *The Africa-South America Connection*, Clarendon Press, Oxford, 1993.
12. Humphries and Parenti, ref. 3, pp. 133, 134 and 151.
13. Hurrell, S., *Dinosaurs and the Expanding Earth*, 3rd edn, One off Publishing, p. 111, 2011.
14. Humphries and Parenti, ref. 3, pp. 128, 131–134.
15. Humphries and Parenti, ref. 3, p. 126–128.
16. Humphries and Parenti, ref. 3, pp. 150–151.
17. Van Damme, K. and Sinev, A.Y., Tropical amphi-Pacific disjunction in the Cladocera (Crustacae: Branchiopoda), *J. Limnology* **72**(s2):210, 2013.
18. Sparks, J.S. and Smith, W.L., Freshwater fishes, dispersal ability and non-evidence: "Gondwana life rafts" to the rescue, *Systematic Biology* **54**(1):158–165, 2005 | doi: 10.1080/10635150590906019
19. Humphries, C.J., Form, space and time; Which comes first? *J. Biogeography* **27**(1):11–15, January 2000.
20. Darlington, P.J., *Zoogeography: The Geographical Distribution of Animals*, John Wiley & Sons, New York, p. 606, 1957.
21. Sanmartin, I. and Ronquist, F., Southern Hemisphere Biogeography Inferred by Event-Based Models: Plant versus Animal Patterns, *Systematic Biology* **53**(2):216–243, 2004.
22. Batten, D. *et al*., *The Creation Answers Book*, Creation Book Publishers, 3rd edn, p. 205–207, 2009.
23. Statham, D.R., Migration after the Flood. How did plants and animals spread around the world so quickly? creation.com/Flood-biogeography.
24. Humphries and Parenti, ref. 3, p. 36.
25. Metcalfe, I. *et al., Faunal and Floral Migration and Evolution in SE Asia-Australasia*, CRC Press, Boca Raton, FL., p. 409–414, 2001.
26. Van Duzer, C., *Floating Islands: A Global Bibliography*, Cantor Press, Los Altos Hills, CA, pp. 362–363, 2004.
27. Lyell, C., *Principles of Geology*, vol. III, John Murray, London, 6th edn, pp. 125–128, 1840.
28. Wallace, A.R., *Island Life*, 2nd and revised edn, Macmillan, London, p. 75, 1895.
29. Brandon-Jones, D., Pre-Glacial Bornean primate impoverishment and Wallace's Line, in Hall, R. and Holloway, J.D. (Eds), *Biogeography and Geological Evolution of SE Asia*, Leiden, pp. 393–403, 1998.
30. De Queiroz, ref. 7, p. 131.
31. Powers, S., Floating Islands, *Popular Science*, September 1911, pp. 303–307; popsci.com.
32. Schuchert, C., *Historical Geology of the Antillean-Caribbean Region*, John Wiley & Sons, New York, p. 80, 1935.
33. Woodmorappe, J., *Noah's Ark: A Feasibility Study*, Institute for Creation Research, Santee, CA, p. 155, 1996.

34. Van Duzer, ref. 26, pp. 59–60, 366.
35. Heatwole, H. and Levins, R., Biogeography of the Puerto Rican bank: flotsam transport of terrestrial animals, *Ecology* **53**:112–117, 1972 | doi: doi.org/10.2307/1935715.
36. Gillespie, R.G. *et al.,* Long-distance dispersal: a framework for hypothesis testing, *Trends in Ecology and Evolution* **27**(1):47–56, January 2012.
37. E.g. Chironomidae, Micropholcommatinae, Ameletopsidae, Coloburiscidae, Nesameletidae, Oniscigastriade, Eustheniidae, Gripopterygidae, Austroperlidae, the water flea genus *Leydigiopsis*, fly genera *Bactrocera, Platyroptilon*, and *Setostylus*, 30 genera and subgenera of crane flies shared between South America and Australasia, and many others, including beetles, moths, butterflies, and dragonflies.[17]
38. Van Damme and Sinev, ref. 17, pp. 209–244.
39. Noonan, G.R., Faunal relationships between eastern North America and Europe as shown by insects, *Memoirs of the Entomological Society of Canada* **20**(S144):39–53, January 1988 | doi: dx.doi.org/10.4039/entm120144039-1.
40. Mesa, A. *et al*., The karyotype of some Australian species of Macropathinae (Gryllacridoidea—Rhaphidophoridae), *Chromosoma* **24**(4):456–466, 1968.
41. Grimaldi, D. and Engel, M.S., *Evolution of the Insects*, Cambridge University Press, Cambridge, UK, p. 485, 2005.
42. Biogeography of Millipede Families, The Field Museum, Chicago; www.fieldmuseum.org/sites/default/files/Identification_Table_3.pdf.
43. Rix, M.G. and Harvey, M.S., The spider family Micropholcommatidae (Arachnida, Araneae, Araneoidea): a relimitation and revision at the generic level, *ZooKeys* **36**:1–321, 2010 | doi: 10.3897/zookeys.36.306
44. Boyer, S.L., Biogeography of the world: a case study from cyphoph Opiliones, a globally distributed group of arachnids, *J. Biogeography*, 2007 | doi:10.1111/j.1365-2699.2007.01755.x.
45. Thiel, M. and Gutow, L., The ecology of rafting in the marine environment. II. The rafting organisms and community, *Oceanography and Marine Biology: An Annual Review* **43**:279–418, 2005; epic.awi.de/11613/1/Thi2005a.pdf
46. Gillespie, R.G. and Clague, D.A. (Eds), *Encyclopedia of Islands*, University of California, p. 302, 2009.
47. Heads, M., *Molecular Panbiogeography of the Tropics*, University of California Press, Berkeley, CA, p. 416, 2012.
48. Vitt, L.J. and Caldwell, J.P., *Herpetology: An Introductory Biology of Amphibians and Reptiles*, 3rd edn, Academic Press, San Diego, CA, fig. 18.3, p. 486, 2009.
49. Vitt and Caldwell, ref. 48, fig. 18.22, p. 501.
50. Vitt and Caldwell, ref. 48, fig. 20.26, p. 539.
51. Elias, S. *et al.,* Life and times of the Bering land bridge, *Nature* **382**:60–63, 4 July 1996.
52. Carranza, S. and Arnold, E.N., Investigating the origin of transoceanic distributions: mtDNA shows Mabuya lizards (Reptilia, Scincidae) crossed the Atlantic twice, *Systematics and Biodiversity* **1**(2): 275–282 |doi: 10.1017/S1477200003001099.
53. Vitt and Caldwell, ref. 48, p. 520.
54. Vitt and Caldwell, ref. 48, p. 489.
55. Vitt and Caldwell, ref. 48, p. 564.
56. Gillespie and Clague, ref. 46, p. 347–351.
57. Ranidae, Hylidae and Bufonidae are disjunct across the Pacific but this could easily be explained by migration across a Bering land bridge. See note 59.
58. Pyron, R.A., Biogeographic analysis reveals ancient continental vicariance and recent oceanic dispersal in amphibians, *Systematic Biology* **63**(5):779–797, September 2014.
59. Volcanic activity during the Flood would have warmed the oceans leading to a much warmer Bering land bridge arising from the surrounding warm water in the North Pacific and Arctic Oceans. Also the copious latent heat generated in the atmosphere from condensation would have contributed to mild winters.
60. Oard, M.J., *Frozen in Time: Woolly Mammoths, the Ice Age, and the Biblical Key to their Secrets*, Master Books, Green Forest, AR., 2004.
61. Statham, D.R., No evidence of evolution and 'deep time', *Creation* **35**(4):40–41, October 2013; creation.com/biogeography–against–evolution.
62. Feder, M.E. and Burggren, W.W. (Eds), *Environmental Physiology of the Amphibians*, University of Chicago Press, p. 527, 1992.
63. Wells, K.D., *The Ecology and Behaviour of Amphibians*, University of Chicago Press, Chicago, IL, pp. 114–116, 2007.
64. Schmidt–Nielsen, K., *Animal Physiology: Adaptation and Environment*, 5th edn, Cambridge University Press, Cambridge, p. 323, 1997.
65. Savage, J.M., The geographic distribution of frogs: patterns and predictions, in *Evolutionary Biology of the Anurans*, Vial, J.L. (Ed.), University of Missouri Press, Columbia, MO., p. 366, 1973.
66. tolweb.org/Pipidae/16986; pddb.org.
67. Olori, J.C., *Tree of Life Web Project*, tolweb.org.
68. Savage, ref. 65, p. 357.
69. The newt and salamander portal; caudata.org.
70. Savage, ref. 65, p. 358.
71. Lomolino, M.V. *et al*., *Biogeography*, 3rd edn, Sinauer Associates, Sunderland, MA., p. 160, 2006.
72. George, W. and Lavocat, R. (Eds), *The Africa–South America Connection*, Clarendon Press, Oxford, ch. 8, 1993.
73. George and Lavocat, ref. 72, ch. 9.
74. tolweb.org/Noctilionoidea/16093.
75. Allaby, M., Dromiciopsia, *A Dictionary of Zoology*, Oxford University Press, Oxford, 1999.
76. Crottini *et al*., Vertebrate time–tree elucidates the biogeographic pattern of a major biotic change around the K–T boundary in Madagascar, *PNAS* **109**(14):5358–5363, 3 April 2012 | doi: 10.1073/pnas.1112487109; pnas.org/content/109/14/5358.full.
77. Noonan, B.P. and Chippindale, P.T., Vicariant origin of Malagasy reptiles supports late Cretaceous Antarctic land bridge, *The American Naturalist* **168**(6):730–741, December 2006.
78. Ali, J.R. and Aitchison, J.C., Kerguelen Plateau and the Late Cretaceous southern–continent bioconnection hypothesis: tales from a topographical ocean, *J. Biogeography* **36**:1778–1784, 2009.
79. Ali, J.R. and Krause, D.W., Late Cretaceous bioconnections between Indo–Madagascar and Antarctica: refutation of the Gunnerus Ridge causeway hypothesis, *J. Biogeography* **38**:1855–1872, 2011.
80. Briggs, J.C., *Biogeography and Plate Tectonics*, Elsevier Science, New York, pp. 118–119, 1987.
81. Darlington, ref. 20, p. 545.
82. De Queiroz, ref. 7, p. 248.
83. Ali, J.R. and Huber, M., Mammalian biodiversity on Madagascar controlled by ocean currents, *Nature* **463**:653–656, 4 February 2010.
84. Kier, G. *et al*., A global assessment of endemism and species richness across island and mainland regions, *PNAS* **106**(23):9322–9327, 9 June 2009.
85. Lomolino *et al*., ref. 71, pp. 651–652.
86. Humphries and Parenti, ref. 3, p. 87.
87. Catchpoole, D. and Wieland, C., Speed species surprise, *Creation* **23**(2): 13–15, March 2001; creation.com/speedy–species–surprise.
88. Wise, K. and Croxton, M., Rafting: a post–Flood biogeographic dispersal mechanism, *Proceedings of the Fifth International Conference on Creationism*, Creation Science Fellowship, Pittsburgh, PA, pp. 465–477, 2003.
89. Batten, D. (Ed.), *The Creation Answers Book*, Creation Book Publishers, ch. 17, 2009.
90. Woodmorappe, J., Causes for the biogeographic distribution of land vertebrates after the Flood, *Proceedings of the 2nd International Conference on Creationism,* Pittsburgh, PA, pp. 361–267, 1990.
91. Humphries and Parenti, ref. 3, p. 21.
92. Myers, N. *et al*., Biodiversity hotspots, *Nature* **403**:853–858, 2000.

Dominic Statham *is a chartered engineer and graduate of Loughborough University in the UK. He has twentyfive years experience in aeronautical and automotive engineering, with Rolls Royce (Aero and Industrial & Marine Divisions) and GKN, a leading supplier of automotive driveline components. He has extensive experience of both manufacturing and product development, and holds a number of patents. He is the author of Evolution: Good Science? Exposing the ideological nature of Darwin's theory*

Trinity's truth reflected in creation

Ian Hodge

In any age, when believing the Christian faith is at a low in the diverse cultures of the world, essential doctrines of the Christian faith are often challenged. Although most of the challenges have already been met in the first few centuries of Christianity, old heresies keep reappearing. One such heresy is a denial of the concept of the Trinity. This essay explores the evidence for the Trinity to be found in creation, and provides commentary on the practical implications of this doctrine.

The doctrine of the Trinity is one of the basic Christian beliefs. It concerns not only the activity of the three Persons in God's plan of salvation, but it addresses a major philosophical question as well—the idea of the one-and-many. This idea is one of the fundamental presuppositions about reality. R.J. Rushdoony writes:

> "Whether recognized or not, every argument and every theological, philosophical, political, or any other exposition is based on a presupposition about man, God, and society—about reality. This presupposition rules and determines the conclusion; the effect is the result of a cause. And one such basic presupposition is with reference to the one and the many."[1]

It might even be argued that the doctrine of the Trinity is the centrality of Christian belief because it helps identify the God whom Christians say is the Creator of the universe. Perhaps it can be argued that the Trinity, while being essential, is an undervalued and underappreciated belief. One writer has gone so far as to suggest that the modernity of our world is the result of a defective view of creation and the Trinity.[2] Thus, a fresh look at the Trinity is in order to see how its practical implications might be understood.

But not only is the Trinity a key doctrine or concept Christian belief, some recent theologians have realized it addresses a central problem related to knowledge. They ask: is there anything that unifies all things; thereby, in the midst of diversity, creating a genuine universe? This question is characteristic of discussions in epistemology;[3] it is referred to as the problem of the one-and-many or as the problem of the existence of universals and particulars. How, then, does the Trinity fit into this philosophical question?

The one-and-many defined

Since the time of Thales there has been discussion on what has become known as the one-and-many problem. There are two parts to the problem of knowledge. First, what is it that unifies everything? Is there some substance such as air, water, fire or earth that is common to all things that provides the unifying principle? If not, is it possible to *make sense* of particular individual objects in the universe? The second part of the problem is the question of individuation: how can we tell the difference between one object and another?[4]

The question of the one-and-many is, as already indicated, therefore, also the problem of universals and particulars. What exactly are universals and particulars? Particulars are the individual things that might be observed. An animal with four legs that has fur is a particular. A thing with four legs that you sit on is a particular. But how is one particular thing distinguished from any other particular thing? That is done by making use of universals. These are categories or generalizations, a way of saying that one particular thing belongs to this category and not another. Thus, an object with four legs that you sit on could be a chair or a horse. And it is by making use of the universals 'chair' and 'horse' the distinction is made (figure 1).

When the phrase *one-and-many* is used in this context, it is important to remember that *many* does not refer to number. It refers to *unity*. Thus, a particular animal we call a horse belongs to a class or group of many animals called horse. The word 'horse', in other words, identifies many individual animals that are *united* in properties (capacities, attributes, qualities, tendencies) that distinguish them from cows or dogs.

There's more. A horse, for example, is an animal and mammal. Animals are distinct from plants. Consequently, people can identify the differences between a rose and a horse, the same way they can tell the difference between a dog and a horse. But without the universal categories such distinctions between particulars are not possible.

The one-and-many of the universe

While the one-and-many issue has application to living (animate) and non-living (inanimate) things, it also has its broadest application in cosmology, in the idea of a *universe*. 'Universe', as has already been alluded to, is a word that combines unity and diversity. It makes us think there is some way of connecting all the diverse particulars of the cosmos with each other. If there is, what is it that even allows us to think such a connection is possible?

Unity comes, as the category of the animal groups indicate, by generalization. This animal kind here has certain features, so we know it is a dog. Without such generalizations all we have are the individual particulars—called 'abstract particulars'. However, abstract particulars have a peculiar feature: *they cannot be known*. The essence of the argument is that abstract particulars are particulars that have no connection to any other particular, and there is, therefore, no possibility of establishing any coherent meaning of the particular that is their bearer. They are what the philosophers call brute facts, or unique facts. They are facts that have no relationship to any other fact. But not only philosophers recognize the notion of brute facts. Molecular biologist Gunther Stent explains,

> "Let us recall, first of all, that science—that is, the effort to abstract causal relations from observable public events, of the outer world—is by its very nature a statistical endeavor. The scientist thinks he recognizes some common denominator, structure, in an ensemble of events, infers these events to be related, and then attempts to derive a 'law' explaining the cause of their relation. An event that is unique, or at least that aspect of an event which makes it unique, cannot therefore be the subject of scientific investigation. For an ensemble of unique events *has* no common denominator, and there is nothing in it to explain; such events are *random*, and the observer perceives them as noise."[5]

In other words, events, or things, or particulars, need something that connects them to something else, a *common denominator*. And it is the common denominator that eventually helps provide meaning for the particular, whatever it might be.

Is there, then, something that ties all the individual parts of the universe together? For the Greek philosophers the answer to this question was to be found within the universe itself: fire, earth, water, or even air. That is, they sought an *immanent* solution to the problem of knowledge. The questions of essence, motion, and being occupied their thoughts, but they were unable to find satisfactory answers to these issues. Two key figures to emerge in the debate were Heraclitus and Parmenides. For Heraclitus, everything was in constant change and motion. The emphasis here is on the many. Nothing remains the same, for you cannot step into the same river twice. Not only has the river changed, but the person stepping into the water has changed, even if imperceptibly. Parmenides, on the other hand, emphasized the oneness of reality—its unchanging nature. Gunton described Parmenides' view as "Reality is timelessly and uniformly what it is, so that Parmenides is the philosopher of the One *par excellence*."[6] It implies that Heraclitus was the philosopher of 'manyness'.

The Greeks sought an *immanent* solution to the one-and-many issue because they believed all reality was one. For them, there was no concept, as there is in Christianity, of an uncreated reality as well as a created reality. Metaphysically, everything was of one 'stuff'. For the Greeks, the many came out of the one. But if everything is ultimately one, how can differentiation be achieved?

When taken to its logical conclusion, as is done in some aspects of Hinduism, there is no plurality of objects in the universe: all is one. In this view, God, man, and the devil

image: iStockphoto/GlobalP

image: iStockphoto/simonkr

Figure 1. Two objects. Both have four legs and you sit on them. But what is the difference, and how is that difference identified?

were ultimately the same. If there is a divine mind, there is no *substantial* difference between that mind and the mind of man. Any difference is one of quality only. But if God, the devil, and man are ultimately the same, then everything is finally meaningless and irrelevant.

Thus, in the case of Plato, all of reality was interpreted in the light of Ideas,[7] but he could not get around the problem of unity and particularity. If particular items cannot be differentiated, then on what basis can particulars be brought together to form some kind of unity? In Christianity, on the other hand, all of reality is interpreted on the basis of the ontological Trinity. And therein lies Christianity's solution to the one-and-many problem, as we shall see below.

Before exploring the solution, consider the idea of the one-and-many has application in other areas, too.

The one-and-many of words

We can also think of words. Each word is a particular. But each particular word finds its meaning within a broader context of universals. Nouns, verbs, subject and predicate, are all categories that provide meaning to *particular* words. Without those syntactical relationships, words are mere sounds and have little or no meaning at all.

The one-and-many of relationships

Any attempt to deal with the question of human relationships identifies very quickly the problem of the one-and-many. What is more important: the marriage or the individuality of husband and wife? In local communities there is a challenge to balance the needs of individuals with that of the community itself. In its broadest terms, politics can be seen as an expression of the one-and-many, where totalitarianism is an attempt at unity by repression of the individual. Complete libertarianism, on the other hand, emphasizes the individual at the expense of the many. Thus the history of mankind can be seen as a panorama of the working out of the one-and-many issue in relationships.

The opportunity that was missed

Reading Greek philosophy is to read the vain attempts to resolve the question of the one-and-many from a non-biblical perspective. It is the key to knowledge, to epistemology. And it should not surprise us that unbelieving philosophers tend to abandon traditional epistemology and limit it to what can be verified, or perhaps try to find the solution in the structure of language.[8] That is because they have not found a genuine way of resolving the problem of identifying any unifying principle. But if you step backwards in time, you find that the Christian theologians were not offering any solution to the problem of the unbelieving philosophers. And it is this failure that Colin Gunton, in his 1992 Bampton Lectures, identifies as the doorway to modernity.

Thus, Christians might have their creedal formulations about the Trinity, but it was a belief that seemed to have very little practical outcome in the world. Or so some people thought. The effect was, however, that the quest for knowledge and a better life led to Christianity being seen as an unnecessary or irrelevant ingredient.

Part of the problem was an imbalance in doctrinal teaching. For example, the monolithic church of the latter Middle Ages seems to emphasize the unity of the one at the expense of the many as people sought a little more freedom from ecclesiastical influence. Gunton states it thus: "much modern social and political thought can be understood as the revolt of the many against the one, and at the same time that of humanity against divinity".[9] This should not be surprising. For as early as the 16th century God was becoming irrelevant to the important questions of epistemology, such as "How do we know?" Francis Bacon (1561–1626) was quite adamant that any attempt to build science on either Greek philosophy or the Bible was an exercise in futility. Rene Descartes (1596–1650), in similar fashion, was arguing that knowledge was certain not because of God's existence but because of his own. *Cogito ergo sum*—I think, therefore I am. The divorce between God and everything else became very bad, a state which historian Henry Buckle expressed as follows:

> "Among the innumerable symptoms of this great movement [of secularism—IH], there were two of peculiar importance. These were the separation of theology, first from morals, and second from politics. The separation from morals was effected late in the seventeenth century; the separation from politics before the middle of the eighteenth century. And it is a striking instance of the decline of the old ecclesiastical spirit, that both of these great changes were begun by the clergy themselves."[10]

The great movement was the secularization of culture. Not that secularization achieved any significant benefit. Apparently when man attempts to find the unifying principle of all knowledge within himself he fares worse, rather than better, as we shall see below.

The history of Christian theology reveals that there was very little attempt to address the issue of the one-and-many from a biblical perspective. It is as if the Bible were silent on the subject. This is acknowledged by Colin Gunton when he said that the modern age "or aspects of it at least, arose out of the failure of the doctrine of creation".[11] It is within the doctrine of the Trinity, however, that the unique biblical response is to be found regarding the one-and-many issue.

Gunton argued that the modern world was a result of the failure of Christendom to develop a theology of creation that dealt with the one-and-many. He attributed the failure to the influence of Platonism in Christian theology. The result was

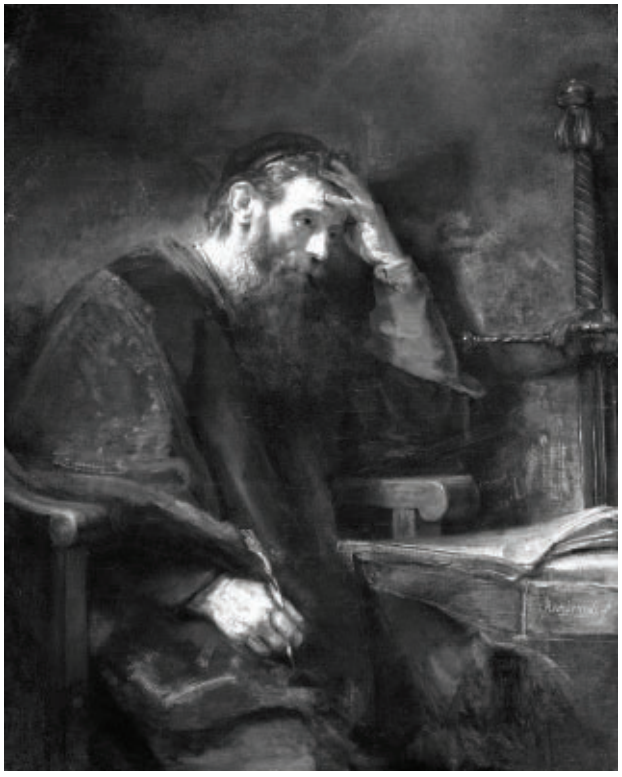


Figure 2. The Apostle Paul.

an abstract doctrine of creation that contributed little to the questions of particularity over 'manyness'. The defective theology, with its emphasis on unity, was abandoned as people then rejected God as their solution to the question of particularity or individuality.

> "Christian theology, although it had every opportunity to develop a theology of creation in which the rights of the particular were given due place, made the major mistake of entering into the wrong kind of compromise with Platonism."[12]

Thus, the problem is a disconnect between the real world elements of the one-and-many—that is, creation—and the doctrine of God.

The solution

With this as background to the issue, we come to the doctrine of the Trinity as a solution to the problem of knowledge, the one-and-many or universals and particulars, and therefore as a solution to the issues of relationships, or community. Christian theism provides a solution to the one-and-many problem in the Trinity where the absolute, self-sufficient God is both unity and diversity. Thus R.C. Sproul:

> "But in the Christian faith, all diversity finds its ultimate unity in God Himself, and it is significant that even in God's own being we find both unity and diversity—in fact, in Him we find the ultimate ground for unity and diversity."[13]

Cornelius Van Til recognized the question of the one-and-many as a metaphysical issue.

> "Using the language of the One-and-Many question we contend that in God the one and the many are equally ultimate. Unity in God is no more fundamental than diversity, and diversity in God is no more fundamental than unity."[14]

This is referred to as the *ontological* Trinity, and describes the relationships of the Trinity within itself.[15]

But if the Trinity is so important, it should be apparent in the universe created by the triune God. And it is, but there are some questions to be answered in order to appreciate both creation and the Trinity.

The origin of the one-and-many

Since universals and particulars can be identified, it is reasonable to argue that they have their origins in God and not in man-made categories distinguishing between particulars. This is precisely what the Bible teaches.

Genesis 1 records the following words:

> "And God said, 'Let the earth sprout vegetation, plants yielding seed, and fruit trees bearing fruit in which is their seed, each according to its kind, on the earth.' And it was so. The earth brought forth vegetation, plants yielding seed according to their own kinds, and trees bearing fruit in which is their seed, each according to its kind. And God saw that it was good" (Gen. 1:11–12).

There, right at the foundation of the universe, God created particulars and kinds (universals). In other words, the very notion of universals and particulars has as its origin in God, who is the ultimate particular and universal, the ultimate one-and-many.

When the Apostle Paul (figure 2) wrote his letter to the church in Rome, he had the idea that the God who created all things—his divine power and attributes—were evident in the creation itself. So clear were they, Paul said, that all men are 'without excuse' when it comes to the question of the existence of God and the origin of the universe.

> "For what can be known about God is plain to them, because God has shown it to them. For his invisible attributes, namely, his eternal power and divine nature, have been clearly perceived, ever since the creation of the world, in the things that have been made. So they are without excuse" (Rom. 1:19–20).

Paul's understanding of God's nature, however, was not a limited, unitarian (i.e. non-Trinitarian) view. For Paul, it was the Messiah in whom we live and move and have our being (Acts 17:28). This point he made again in his first letter to the Corinthians when he wrote, "yet for us there is one

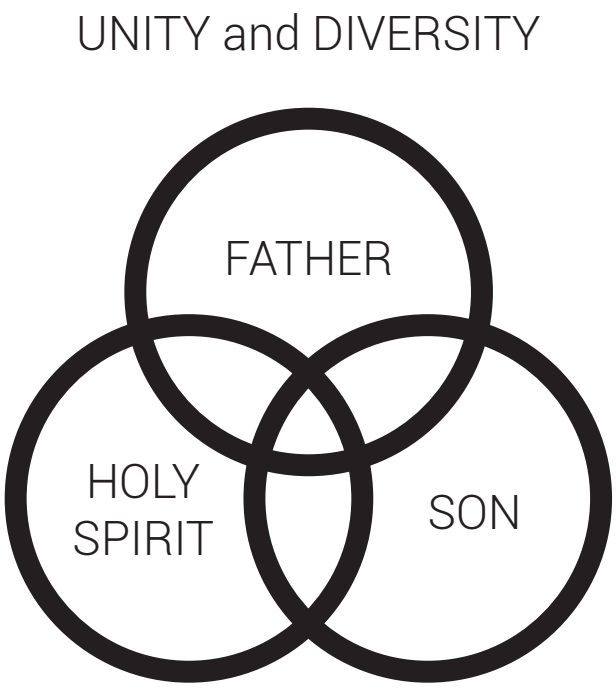


Figure 3. The ontological One-and-Many is thereby an explanation for the existence of universals and particulars.

God, the Father, from whom all things come and for whom we exist; and one Lord, Yeshua the Messiah, through whom were created all things and through whom we have our being" (I Cor. 8:6, CJB). Paul was clear on the origin of *existence*, echoing the words of John's Gospel:

> "In the beginning was the Word, and the Word was with God, and the Word was God. He was in the beginning with God. All things were made through him, and without him was not any thing made that was made. In him was life, and the life was the light of men" (John 1:1–4).

It was the Gospel of John, more than any other, which encouraged the development of the idea of the Trinity. It is not too difficult, then, to take a small step from the words of Scripture concerning God to the creation and the Trinity. Because universals and particulars are found in the creation, the creation reveals not only the power of God but his attributes. Creation reveals a one-and-many universe brought into existence by a one-and-many triune God.

Implicit in the *facts* of the universe from the biblical position is the idea that *all facts* are *created facts* (except God, who is, by definition, uncreated, since He is eternal). No fact derives its true meaning from any other source other than the Creator. This is another meaning in the words of Paul, that the creation reveals the Creator. And because all the facts of the universe are known by God and are where they are by the creative act of God, there really is a *uni*verse that is not an accumulation of unknowable abstractions. Without such a belief in a unifying principle in a universe, science is not possible. It is the unifying principle, the common denominator, that provides order and coherence—rationality—to the universe. This is one of the unproven assumptions of science.[16] So it is not a coincidence that science has grown on the back of a Christian culture and worldview in the West.[17]

God is the author of the one-and-many

Thus, in *Christian* theology, the *temporal* one-and-many is set over against the *ontological* One-and-Many, God. The ontological One-and-Many is thereby an explanation for the existence of the temporal one-and-many. Such a view does not exist outside of Trinitarian Christianity, so it is not surprising that the general discussion of the one-and-many issue outside of Trinitarian Christianity rarely takes place (figure 3). Secular philosophers ignore the question because an adequate resolution to the issue has not been found by them. But biblical commentators can also miss the point because they do not appreciate the implications of the doctrine of the Trinity. Anthony Buzzard, for example, argues that the Trinity is Platonic in origin.[18] In dismissing the topic, however, it was evident he had no intention of supplying any alternative explanation for the existence of universals and particulars. Such a dismissal naturally fails to explain why the universe reveals the one-and-many, universals and particulars. Why is the universe like this? Since God created the universe, what did He use as a model for the universals-particulars universe? The doctrine of the Trinity suggests that God Himself is the model of the universe. There is no answer to that question of what ties *everything* together, the one-and-many, outside of the Trinitarian concept of God. In other words, the universe reflects God Himself. God's revelation of Himself in both Scripture and his creation thus weaves a single story.

Practical considerations

The one-and-many issue, however, is not simply a cosmological question. It has implications in human relations. This led Colin Gunton to ask, "In what manner is, or should be, a human society a unity or totality; and in what sense a set of more or less loosely connected individuals?"[19] R.J. Rushdoony devoted a whole book to the practical implications of the Trinity in a discussion on political theory.[20] The history of mankind is an ongoing story of the struggle to find the balance between unity and diversity. Should the individual be free to do as he pleases? If so, how can there be unity (or, we might say, community)? Or is the individual to be suppressed and absorbed into the One? If so, what is the One that will absorb individuality?

The Greeks, unable to find a *transcendent* answer to the one-and-many issue, ended with an *immanent* answer, individual man subject to politics. Hence Plato, in his

Republic. But with the incarnation of Jesus Christ, and the subsequent development of the Trinity, a universal was found that was truly transcendent. This means, among other things, that the political order *cannot* be the unifying principle for man. For the political order itself is subject to God, the ultimate One-and-Many.

Throughout the ages the question of man in society has been discussed, and central to this is the role of the state. In the doctrine of the Trinity there is an equality of the One-and-Many. God is both one and many at the same time, and because He is absolute perfection, there is equal ultimacy of the One and the Many. In God, there is both individuality and unity and they are equally important. In God, unity does not destroy individual persons, nor do the individual persons destroy unity. They are equal in every way.

In practical terms, the doctrine of the Trinity stands against all forms of totalitarianism in the activities of man. Neither church nor state can claim a form of absoluteness that enforces oneness (unity) at the expense of the many (individuality). Thus it is not surprising to find that where Trinitarianism has triumphed, so too has the idea of liberty for man in the political realm. All forms of communism or totalitarianism are rejected because they attempt to force the oneness or unity of man at the expense of the individual. But at the same time, anarchy is also rejected because it promotes the individual at the expense of unity. Even in family, the Trinity provides a frame of reference for balancing the family as a unit against the individuals in the family.

The non-Christian world struggles with an either/or understanding of particulars and unity. Because anarchism has so low an acceptance due to its near impossibility, the swing in non-Christian cultures is to unity—the total absorption of the individual into the body politic, the state. The later Caesars of the Roman Empire sought unity, and the origin of the Christian persecutions were an attempt to stamp out diversity in the Empire. Another example of this is Islam, with its concept of Allah as a monad. In the words of Robert Letham:

> "Islam's doctrine of God leaves room neither for diversity, diversity in unity, nor a personal grounding of creation, for Allah is a solitary monad with unity only. The Islamic doctrine of God is centered on power and will. There is virtually no room for love."[21]

Any love in this context would amount to narcissism, almost the direct opposite of the biblical concept of love.

When people today realize the encroachments of the political order upon individuality in various forms, such as control of education, even in private schools, what they are witnessing is the unbeliever's solution to the one-and-many issue. Having denied the Triune God as the resolution of the one-and-many problem, unbelievers locate the solution in the only place remaining, man himself, and in particular the political order, the state. But man, especially sinful man, has nothing within himself to balance unity and diversity, so the drift towards totalitarian is both noticeable and real.

What now?

The rise of the Enlightenment and its rejection of God, however, raised the question of the one-and-many again, though many people did not realize it as such. But with the abandonment of God came the rejection of God as the unifying principle of all things.

What did the Enlightenment propose as an alternative to the one-and-many problem, which is inescapable (just because God is rejected does not mean the *concept* of the one-and-may disappears)? Rather, it means the attributes and powers of God are merely transferred somewhere else.

Where, then, is the unifying principle in the post-Enlightenment to be found? There are obvious contenders, such as the pursuit of happiness. But a much stronger candidate is this: the mind of man, who is to bring unity to the universe but which does so *without* any reference to God. Thus Gunton:

> "God was no longer needed to account for the coherence and meaning of the world, so that the seat of rationality and meaning became not the world, but the human reason and will, which thus *displace* God or the world. When the unifying will of God becomes redundant, or is rejected for a variety of moral, rational and scientific reasons, the focus of the unity of things becomes the unifying rational mind."[22]

What started as air, water, fire and earth has now become the autonomous reason of man himself. And if events in the world are any indication of the failure to find a meaningful answer to the one-and-many, this is not working out very well. The French and Bolshevik Revolutions stand as monuments to man's failure to provide a principle that balances individuality and unity.

From a biblical perspective, it all began with the attempt of man to "be like God" (Gen. 3:5), and is a unifying principle doomed from the outset. In the history of man, "unitary deity, whether theist or deist, is commonly seen to be at the root of totalitarian or repressive forms of social order".[23] If the unifying principle is man and now man 'playing God', then the man-god is a 'unitary deity' and totalitarian and repressive forms of social order are the consequence. "[T]he displacement of God does not and has not given freedom and dignity to the many, but has subjected us to new and often unrecognized forms of slavery."[24]

It is reasonable to say, as the modern world struggles with the questions of unity and diversity, and personal freedom against national unity, the Christian doctrine of the Trinity provides a true balance in what is a largely unbalanced arrangement in human relationships.

Music and the trinity

A few comments about music, my own profession, are in order. Western music had a high point in relation to the concept of the Trinity and is especially characteristic of the music of Johann Sebastian Bach (1685–1750). For example, a fugue is a composition that has many voices, but they create a unity in sound. It is not a mere 'accident' of Western culture that such music should arise in those places most affected by Trinitarian belief. Bach may not have self-consciously thought *I'm composing Trinitarian music*, but he inherited a rich background of counterpoint that allowed him to take a particular art form to its highest pinnacle, a true application of the One-and-Many in everyday life. As the culture has moved away from its Trinitarian moorings, music has tended to be either a single unity (melody) with harmony, or has broken down into a cacophony of individual but unrelated sounds. It is the opinion of the writer that 'avant-garde' art can, therefore, be seen as the empty hope of creating unity out of chaos, which echoes the ancient Near-Eastern chaos religions.

Conclusion

The doctrine of the Trinity is a very important doctrine, not only for our understanding of the nature and character of the Creator, but also that of the world in which we live. Without such a doctrine that explains the one-and-many (universals and particulars), the scientific community lacks an adequate justification to distinguish between a dog and a horse. The development of science in the Trinitarian Western world is an illustration of the practical aspects of Christian theology.

But the idea of the Trinity works in abstraction without the doctrine of creation. It is only as the doctrine of creation in all its fullness is restored that the Trinity can once again become the unifier of both cosmology and social order.

So, too, has the development of federalism as a political concept been unique to Christianity. Under federalism, each area (e.g. state, nation, family) has its own unique jurisdiction, and one sphere should not encroach on the God-given areas of the others. This serves to prevent the development of a totalitarian regime, instead balancing the immanent one-and-many with the transcendent One-and-Many, who alone is capable of creating community without destroying individuality or the individual.

In the area of politics, the Trinity provides a balance to be applied in the practice of order and ultimacy. And it is only a return to orthodox Trinitarian Christianity that can provide an antidote to the totalitarian dreamers and a satisfactory solution to the meaning of the universe.

In the broader context of human relationships, the doctrine of the Trinity provides a rich framework for balancing the needs of individuals against those of the group. The practical application of the Trinity is thus an urgent and necessary task by those who hold to the "faith which was once for all delivered to the saints" (Jude 1:3).

References

1. Rushdoony, R.J., *The One and the Many: Studies in the Philosophy of Order and Ultimacy*, Kindle edn, Loc. 194, Chalcedon/Ross House Books, 2014.
2. Gunton, C.E., *The One, The Three and The Many: God, Creation and the Culture of Modernity*, Cambridge University Press, 1993. The chapters in this book were originally delivered as the 1992 Bampton Lectures.
3. Epistemology is the study of knowledge and of justified belief. For more detail see plato.stanford.edu/entries/epistemology/.
4. In some instances, Hinduism denies individuation of objects, suggesting there is no plurality of objects in the world. All is one.
5. Stent, G., *The Coming of the Golden Age: A View of the End of Progress*, The Natural History Press, Garden City, NY, 1969; p. 116, emphasis in original.
6. Gunton, ref. 2, p. 18, emphasis in original.
7. In Plato's thought, what you could see our touch or hear was only a representation of the Form or Idea which was the unseen 'ultimate reality'. Hence, everything was interpreted on the basis of this ultimate reality.
8. Such as found in the Whorf-Sapir hypothesis, www.princeton.edu/~achaney/tmve/wiki100k/docs/Sapir%E2%80%93Whorf_hypothesis.html.
9. Gunton, ref. 2, p. 27.
10. Buckle, H., *History of Civilization in England*, vol. 1, Longmans, Green & Co., London, pp. 424–425, 1869.
11. Gunton, ref. 2, p. 4.
12. Gunton, ref. 2, p. 51.
13. Sproul, R.C., *What is the Trinity?—Crucial Questions Series Book 10*, Reformation Trust Publishing, Kindle edn, p. 14, 2011.
14. Van Til, C., *The Defense of the Faith*, The Presbyterian and Reformed Publishing Company, Philadelphia, PA, p. 26, 1955.
15. When referring to the Trinity and its relationships with the creation, theologians speak of the *economical* Trinity.
16. Reed, J.K., *Rocks Aren't Clocks*, Creation Book Publishers, Powder Springs, GA, p. 47, 2013.
17. Stark, R., *How the West Won: The Neglected Story of the Triumph of Modernity*, Intercollegiate Studies Institute, Wilmington, DE, 2014, 2014. See also Mangalwadi, V., *The Book That Made Your World: How the Bible Created the Soul of Western Civilization*, Thomas Nelson, 2011.
18. Buzzard, A., *Jesus Was Not A Trinitarian*, Restoration Fellowship, Restoration Fellowship, 2007, Morrow, GA, Kindle edn, Loc.120ff, 2007.
19. Gunton, ref. 2, pp. 18–19.
20. Rushdoony, R.J., *The One and the Many: Studies in the Philosophy of Order and Ultimacy*, Ross House Books, 2nd edn, 2007.
21. Letham, Robert, *The Holy Trinity*, P&R Publishing, Phillipsburg, NJ, p. 442, 2004.
22. Gunton, ref. 2, p. 28.
23. Gunton, ref. 2, p. 25.
24. Gunton, ref. 2, p. 29.

Ian Hodge, AMusA, Ph.D. *Ian earned his doctorate from Whitefield Seminary in "Christian Intellectual Thought—Economics" in 1994. A former professional musician and business consultant, he is currently Manager of Ministry and Marketing for* Creation Ministries International (Australia). *He is the author of several books and over 500 published essays on applied Christianity in areas such as apologetics, theology, business, music, law, politics, education and economics.*

Nylon-eating bacteria: part 1—discovery and significance

Royal Truman

The manufacture of nylon-6 generates waste materials not present before in nature which several bacterial species can degrade. Three enzymes (E-I, E-II, and E-III), able to hydrolyse various amide bonds in these waste substances were shown to be responsible for these processes. The optimized versions of these enzymes are likely to have arisen within a few decades, mostly under selection in a laboratory. In the first of this 4-part series we show that this waste degradation is not evidence for purposeless evolution but is consistent with a creation model of flexible organisms and ecologies, front-loaded to be adaptable to future environments and contingencies. A summary of the extensive literature on 'nylon-eating bacteria' is offered herein, followed in parts 2 and 3 by key publications dealing with the origin of the key modified enzymes. This background overview then permits the essence of the matter to be analysed in part 4 using Coded Information System Theory, where we argue that the most sophisticated information processing architectures are multi-purpose, open systems, which are a clear indication of design and not chance.

Microorganisms play indispensable ecological roles that benefit all life forms on Earth. Nitrogen fixation converts N_2 and carbon fixation converts CO_2 into substances usable by other organisms. Many of the nutrients needed by complex organisms are the break-down products of enzymes present only in bacteria. Without recycling of organic matter to valuable raw materials, much of the usable source of carbon, nitrogen, and oxygen would soon be depleted.

After creation, many new ecological challenges and interactions between organisms developed, and a proper design would have to be flexible and adaptable, or require constant direct corrective intervention.

Evolutionists often rely on examples of putative suboptimal designs to deny a divine creation and plan. Hence, if over time the biosphere were actually unable to adapt to new circumstances, this would be construed as suboptimal design and proof of lack of divine foresight. Inability to protect the environment, including rendering harmless substances that are poisonous to other organisms, would be consistent with purposeless evolution. However, both atheists and theists would expect God to anticipate these ecological challenges, including those substances that would be manufactured by man. Our worldview also includes the deleterious effects of the Fall and therefore a well-functioning but less-than perfect biological world thousands of years after creation.

The mechanisms of adjustment provide important clues for deciding whether chance or pre-intended adaptability offer a better interpretation. To illustrate, an immune system must react *quickly* to be of any use, within the lifetime of a challenged organism. Suppose countless lineages went extinct all the time due to viral or bacterial infections and very rarely random mutations in the germ-line permitted some to survive. Such an inefficient, cruel evolutionary mechanism could legitimately be viewed as due to chance.

However, maturation of B-cells, a key immune defence mechanism, is known to be precisely guided,[1–4] with the necessary components already in place. Only a small 15–22 amino acid portion of an antibody (the paratope) is refined through an iterative mutational algorithm (mutations that can't harm the germ-line). The optimized paratope has a shape and charge distribution which complements a portion of the invader's antigen (the epitope), targeting it to be destroyed by the B-cell.

The necessary somatic mutations are mechanistically induced and are not the result of flawed replication of DNA, relying instead on recombination signals[5] in the right kind of cell, at the precise best location of the resulting protein. A single germ-line mutation leading to a novel function could be interpreted in evolutionary terms but design is clearly a better explanation when complex machinery has been set up to guide a process of iterative fine-tuning during an organism's lifetime.[6] In-depth analysis of the underlying causal factors is often necessary before arguing chance or design, which is why we devote much effort to parts 1–3 of this series.

Various bacteria are known to carry plasmids (small circular DNA elements) with genes that code for enzymes able to break down unnatural substances such as toluene, camphor, salicylate, alkanes, and naphthalene.[7] The degradative effectiveness of these enzymes can be improved with minor fine-tuning through mutations. Everything reported so far on this topic is consistent with foresight in anticipation of future challenges.

'Nylon-eating' bacteria

In 1975, a research team from Osaka University in Japan investigated whether bacteria could live off synthetic materials collected from the waste water released during nylon-6 production.[8] Nylon-6 is produced by ring cleavage polymerization of caprolactam (figure 1) and its manufacture releases unnatural materials such as ε-caprolactam, 6-aminohexanoic acid cyclic dimer, and 6-aminohexanoic acid oligomers into the environment.

By selectively subculturing the variants able to grow most rapidly in ε–aminocaproic acid cyclic dimer, a population designated K172 was isolated[9] that could grow on this dimer as its sole source of nitrogen and carbon but could also metabolise several other organic waste materials.[10]

Since nylon production began in the 1930s, it seemed unlikely that highly tuned enzymes that are able to metabolise these unnatural waste substances should already have existed, which led to much discussion as to whether this was evidence for evolution of *de novo* proteins. In fact, three enzymes analyzed in sp. K172 were able to degrade three synthetic compounds, and seem to be quite different from enzymes present in any of the other *Flavobacterium* species reported.

Although it is known that other microorganisms can also hydrolyse linear and cyclic oligomers of ε–aminocaproic acid, this is the first report of a bacterial species using synthetic substances as its sole source of carbon and nitrogen nutrient.

We examine next the three new or, more accurately, *modified* enzymes that are able to degrade waste substances resulting from the manufacture of nylon-6: E-I, E-II, and E-III.

E-I. Hydrolysis of 6-aminohexanoic acid cyclic dimer (Acd)

Flavobacterium sp. K172 (reported as *Achromobacter guttatus* K172 in the older literature) is a bacterial strain found in damp soils and fresh water. Research led by Negoro and Kinoshita showed that new colonies could grow on a medium containing 6-aminohexanoic acid cyclic dimer (Acd), a side product of nylon-6 manufacture, as the sole source of carbon and nitrogen (first reaction shown in figure 2).[11]

The enzyme E-I displayed considerable substrate specificity and did not measurably process several other aminohexanoic acids and polypeptides (as determined by the laboratory sensitivities available over three decades ago). The low kinetic turnover number (8 s^{-1}) compared to other cyclic amide hydrolases (e.g. 35–260 s^{-1} for penicillinase) raised the possibility that a variant enzyme had adapted to a new synthetic substrate.[12] Plasmid depletion experiments (i.e. elimination from the host) identified plasmid pOAD2 as supplying the necessary gene.[13]

The ability to degrade Acd was also found in another bacterial species, *Pseudomonas* sp. NK87,[14] isolated from the waste water of a nylon factory in Unitika, Uji, Japan. This strain was also able to grow on Acd as the sole source of carbon and nitrogen.[15] The wild-type gene already functioned to some extent in free nature and could be optimized under carefully guided strong selection in a laboratory at 30°C for two to three days. Colonies that appeared were further purified on Acd plates.

E-II. Hydrolysis of 6-aminohexanoic acid oligomers (Ald)

Flavobacterium sp. K172 (reclassified later as *Arthrobacter* sp.) was isolated from the waste water of a nylon factory.[16] An enzyme was isolated that could hydrolyse the second step in the pathway presented in figure 2, using 6-aminohexanoic acid oligomers ranging from dimer to hexamer and icosamer. It did not hydrolyse hectamers, however. The activity decreased with increase of the polymerization number of the oligomer.

The 6-aminohexanoic acid residue was removed successively from the amino terminus. However, the enzyme could not hydrolyse other linear amides, cyclic amides, dipeptides, or tripeptides tested, such as 6-aminohexanoic acid cyclic dimer, 6-caparolactam, 5-valerolactam, 2-pyrrolidone, 30 kinds of peptides, 8 kinds of tripeptides, tetra-alanine and penta-alanine, casein, 6-N-acetyllysine, N-acetyltrialanine, N-carbobenzoxyglycylleucinamide, N-acetyltrialanine methyl ether, glutamine, and asparagine.[16]

High enzyme specificity had also been reported for E-I in the same bacterial strain,[8] and the genes for E-I and E-II were located at distant sites on the same plasmid. E-II hydrolase activity was also observed in another bacterial strain, *Corynebacterium aurantiacum,* which led the authors to suggest an independent origin for both kinds of genes although they did not propose from which genes. Significantly, they pointed out that adapting to unnatural synthetic compounds, such as nylon oligomers, does not seem to be a very rare phenomenon in nature.[17]

Further insight was gained when Negoro *et al.*[18] analysed the pOAD2 plasmid by cleaving it with various restriction endonucleases *(Eco*RI, *Hind*III, *Bam*HI, *Sal*I, *Pst*I, *Bgl*II, *Mlu*I, *Pvu*II, *Xho*I, *Sma*I). Fragments were ligated to a standard research vector (pBR322) and transformed to

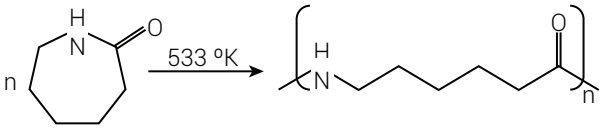


Figure 1. Ring-opening polymerization of caprolactam to form nylon-6.

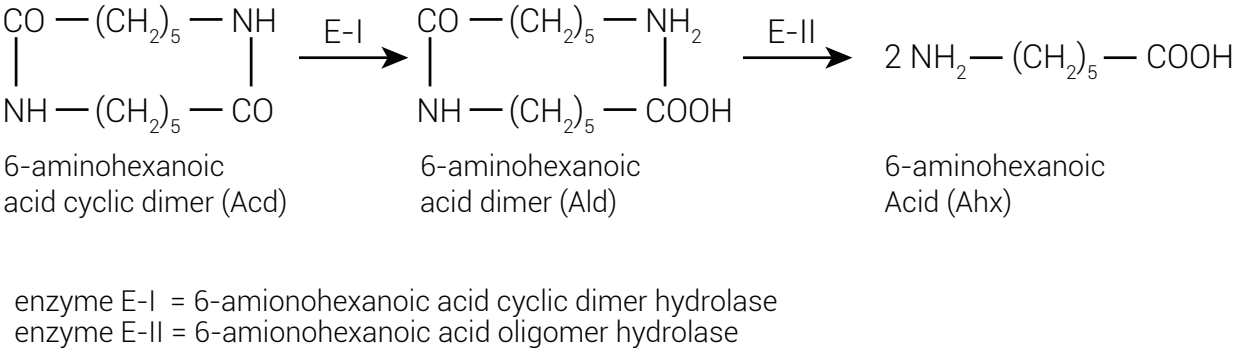


Figure 2. Enzyme degradation pathway of 6-aminohexanoic acid cyclic dimer to 6-aminohexanoic acid.
Enzyme E-I = 6-aminohexanoic acid cyclic dimer hydrolase.
Enzyme E-II = 6-aminonohexanoic acid oligomer hydrolase.

E. coli recipients, which were able to survive exposure to ampicillin. Transformed *E. coli* were isolated and shown to possess E-I and E-II enzymatic activity. This confirmed that both enzymes were present on the same plasmid in K172. By systematically analysing shorter deletion fragments the precise locus of the gene that codes for E-II on the plasmid was identified.[19]

Analysis of hybridisations between a DNA fragment on plasmid pOAD2 that contained the gene that codes for E-II showed no similarities with portions of the other two plasmids in K172, nor chromosomal DNA. However, some hybridisations did occur between fragments that contained the genes that code for E-I and the E-II with other portions of plasmid pOAD2. Without actual DNA sequence data, made possible about two decades later, little could be concluded at that time about the degree of similarity and whether recent gene duplications may have occurred. It was concluded that two fragments containing the gene that codes for E-II were present but only one led to a functional E-II protein.[20]

The enzyme resulting from gene *F*-E-II (from *Flavobacterium*) was reported to degrade 6-aminohexanoate oligomers with chain lengths between two and 20 subunits. The *P*-E-II enzyme[21] found in *Pseudomonas* sp. NK87 exhibited similar activities against oligomers of 6-aminohexanoate ranging in chain length between two and five subunits, and no significant activities against 56 different dipeptides tested.[10,11] P-E-II and F-E-II were believed to digest the oligomers stepwise starting at the amino-terminus.[22]

E-III. Hydrolysis of endo-type 6-aminohexanoate (Ahx)

Plasmid pOAD2 in *Arthrobacter* sp. K172 (formerly called *Flavobacterium* sp. K172) also contains the gene F-E-III, which codes for a third enzyme (NylC).[23]

The enzyme NylC could also degrade larger cyclic polymers derived from Ahx[24] and larger linear oligomers,[25] see figure 3. E-III was also discovered in *Pseudomonas* sp. NK87.[26]

In another study,[27] degradation of Ahx was developed in the laboratory using a new bacterial strain that is not inherently capable of such activity, *Pseudomonas aeruginosa* PAO. The wild type could process neither Acd nor Ald. The nutritional source of carbon and nitrogen was limited to Ahx. After 9 days of incubation a mutant strain able to grow on Ahx was transferred to an Ald minimal medium. In the third week some growth was observed in one of the cultures, which was retransferred to an Ald minimal medium. In the third month significant growth rates were obtained. A strain (PAO5002) was isolated and shown to grow rapidly on either Ald or Acd, even after changing the nutrient to glucose. This result demonstrated that the extraordinary lag (ca. 3 months) was not due to very slow growth of the parental line.

The bacteria could remain in a starved condition for a long time and thus accumulate many genetic alterations within the same generation in order to activate a cryptic region. Alternatively, the high frequency of hyper-growing mutants in medium containing Ahx might be a result of a high mutation rate under starvation conditions.[11] Environmental stress can cause adaptive mutations by increasing polymerase error rates[28] and by recombinations.[29] Other researchers have observed up to 10,000-fold increase in Mu element excision due to starvation.[30]

The authors concluded that two enzymes formerly not found in *P. aeruginosa* PAO had arisen, able to hydrolyse Acd into Ald and then onto Ahx, although the exact pathway was not determined.[31]

Widespread existence of enzymes E-I, E-II, and E-III

Other microorganisms, taken from a sewage disposal plant and from waste water from a nylon factory, were also able to metabolise waste products from nylon-6 production after incubation for five to seven days on cyclic-oligomer-enriched

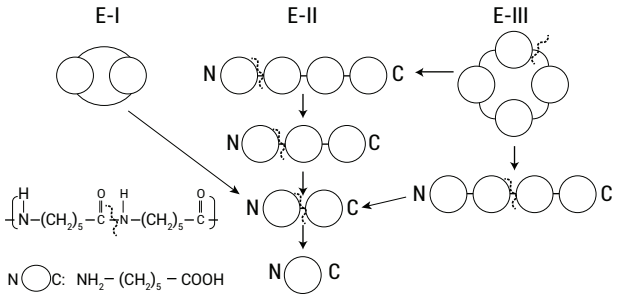


Figure 3. Degradation steps of nylon oligomers by enzyme E-I, E-II, and E-III (which codes for NylC).

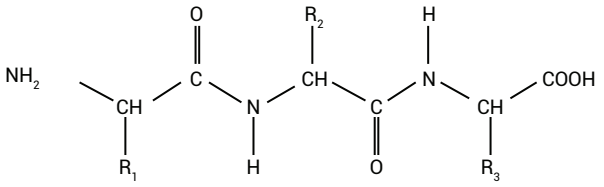


Figure 4. Cleave of peptide bonds (which are amide bonds) in proteins.

waste.[32] All strains (two from the sewage disposal and five from the nylon factory) produced enzymes similar to E-II (called nylB in the paper) known from *Arthrobacter* K172. All but two strains from the nylon factory had similar proteins to the E-I enzyme (called nylA in the paper).[33]

Strain KY5R from the nylon factory was identified as *Agromyces*, and KY2 (from the sewage disposal plant) as *Kocuria*.[34] Both are alkalophilic bacteria and further experimentation revealed that they possess an additional gene that codes for an enzyme able to hydrolyse larger cyclic oligomers derived from Ahx. These enzymes were labelled $NylC_{p2}$ (from *Arthrobacter*), $NylC_A$ (from *Agromyces*) and $NylC_K$ (from *Kocuria*).[35] The polypeptides contain 355 residues in all three cases, the same ATG initiation codon, and the same Shine-Dalgarno sequences[36] (GGAGG). Relative to the $NylC_{p2}$ 355 residue sequence, $NylC_A$ and $NylC_K$ have 5 and 15 amino acid substitutions, respectively, and their genes are hypothesized to reside on the chromosome and not plasmids.[37]

These three enzyme variants are generated after a post-translational proteolytic cleavage, which is a specific feature of the N-terminal nucleophile (N-tn) hydrolase family. This is significant for part 3 of this series.

Once an enzyme's scaffolding is in place, replacing just a few amino acids at specific locations can often modify the enzyme's properties. A thermostable variant of $NylC_{p2}$ produced in the laboratory by replacing four carefully selected residues was able to hydrolyse mechanically disintegrated nylon-6 powder at 60°C,[35] a discovery of potential industrial applications. The fragments produced tended to remain bound to the nylon polymer through hydrogen bonding but smaller fragments (<10 monomeric units) which separated from the polymer were degraded by a subsequent NylB-based reaction.[38]

Discussion

The chemical bonds cleaved by hydrolases are present in many kinds of bio-chemicals, such as proteins (figure 4) and many kinds of enzymes are able to hydrolyse them.

Of particular interest here are amide bonds, a fundamental feature of proteins. Proteins are usually extensively modified biochemically after translation. Furthermore, after being folded in three dimensions, embedded in membranes, or linked to sugars or to other bio-molecules, the protein's amide bonds are found in a large variety of electronic and steric environments. Nevertheless, the enzymes easily recycle these proteins. With this in view, it is not particularly surprising that existing enzymes could fairly easily be modified to hydrolyse amide bonds of substances such as those shown in figures 2 and 3.

Many potential precursor candidates for E-I, E-II, and E-III, present in many varieties, are already distributed among bacterial strains. In addition, as Batten pointed out, plasmid pOAD2 has the means to enhance rapid mutations.

> "There are five transposable elements on the pOAD2 plasmid. When activated, transposase enzymes coded therein cause genetic recombination. Externally imposed stress such as high temperature, exposure to poisons, or starvation can activate transposases. The presence of the transposases in such numbers on the plasmids suggests that the plasmid is designed to adapt when the bacterium is under stress."[39]

Negoro's group already reported[40] that the five IS6100 elements are *identical* on the plasmid over 880 base pairs (bp), except that the 420-bp region was duplicated in one case ($RS\text{-}I_B$) and two of them have a reversed orientation on the plasmid. Furthermore, the IS6100 sequence was identical to the one found on *Mycobacterium fortuitum* and seems to be widely distributed among microorganisms.[41] Sequences similar to IS6100 were also found in *Pseudomas* sp. NK87 on plasmid pNAD2, which contains the NylA gene.[23] In agreement with Batten, Negoro concludes that the IS6100 sequences cannot be very ancient or they would display far more sequence variety.[23]

This is consistent with another key observation. Batten added:

> "The Japanese researchers demonstrated that nylon degrading ability can be obtained *de novo* in laboratory cultures of *Pseudomonas aeruginosa* [strain] POA, which initially had no enzymes capable of degrading nylon oligomers. This was achieved

> in a mere nine days! The rapidity of this adaptation suggests a special mechanism for such adaptation, not something as haphazard as random mutations and selection… . It seems clear that plasmids are designed features of bacteria that enable adaptation to new food sources or the degradation of toxins."[39]

Another example was reported in which enzymatic activity appeared after only 14 days.[42] A variant of *Flavobacterium* (K1725) from which the entire E-I gene sequence had been removed, could not grow on waste which consisted primarily of 6-aminohexanoate-cyclic oligomers but did have about 5% of the activity of the unmodified K172. Plated on a minimal waste medium, cells from strain K1725 produced colonies spontaneously with activity two – to six-fold higher.

Again, all this is not very surprising because the system is very simple. As Behe pointed out,

> "Those enzymes are very simple ones which simply hydrolyse precursors to nylon. That's a very simple task, which can be done even by small organic catalysts."[43]

Negoro also reiterated the known fact that environmental stress can lead to adaptive mutations by generating polymerase errors and, in addition, recombination can also be involved in adapting to crisis situations.[44] As another example, Lenski had already shown a 10,000-fold increase in bacterial Mu element excision induced by starvation, as mentioned above.[30]

Drake estimated a typical rate of mutation for bacteria of 10^{-10} to 10^{-9} per nucleotide per generation,[45] which is probably representative of plasmids. Plasmids are generally dispensable for bacteria, can be present in multiple copies, are much smaller than bacterial chromosomes, and can be transferred to other bacteria. Plasmid pOAD2, which contained genes E-I, E-II, and E-III, was reported to consist of 44,000 nucleotides.[46] Being so much smaller than the host chromosome, the chances are much better of avoiding a deleterious mutation somewhere along its sequence. Proportionally, many mutations should be tolerated, since plasmids need not be permanent components of the genome and therefore aren't as critically important as the main chromosome. Furthermore, several copies of a plasmid tend to be present.

For large bacterial populations, it is likely that most or all non-deleterious single nucleotide alternatives of the genes coding for E-I, E-II, and E-III precursors were already present on a plasmid, plus many cases of multiple mutations. Upon initial contact with side-products of nylon production, a minimally functional gene was already available or easily attainable after a few mutations. Strong selection under harsh mutation-increasing conditions, as created in the laboratory experiments, could then fine-tune upon a favourable starting point.

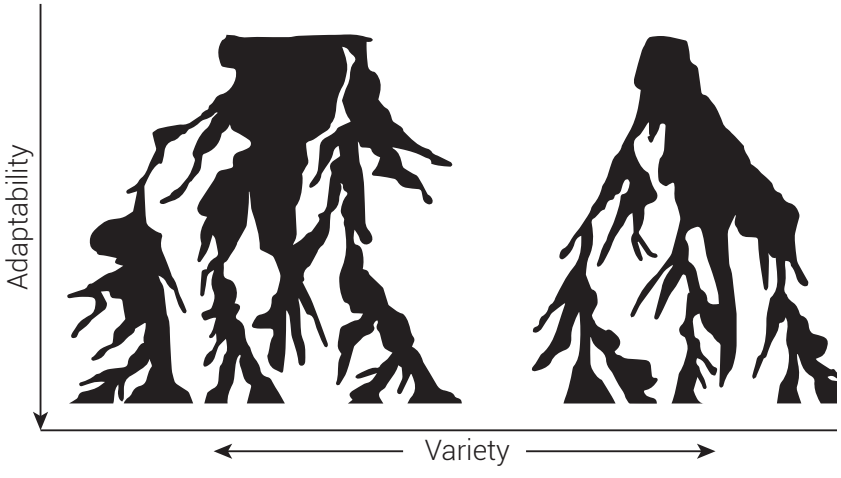


Figure 5. Model for front-loaded adaptability. Initially there were separate categories of generalist life-forms, which specialized to new environments.

Adaptation vs true evolution

Degradation of bio-chemicals or related synthetic materials by bacteria does not support the notion of macro-evolution. Creation scientists hold to the view of flexible organisms designed to cope with their environment. This flexibility includes continual adjustments, such as temperature regulation, digestion of different foods, decision making such as in normal walking, and numerous other forms on non-deterministic behaviour. Minor adjustments requiring several generations are also part of the ecological design plans. Anderson and Purdom point out that "a wide range of mutations can be shown to provide a beneficial phenotype to the cell"[47] but also that these mutations "frequently eliminate or reduce pre-existing cellular systems and functions. This has been referred to as antagonistic pleiotropy". An example is genomic truncation,[48,49] whereby valuable energy and material can be saved under duress by eliminating genetic elements not needed at that time.

These kinds of fine-tuning, linked to clear guiding processes, provide no support for evolutionary claims such as development of joints or organs from a single cell predecessor. Naturalistic mechanism must not be confused with magic. As Gatlin pointed out astutely in *Information theory and the living system*, "The words 'natural selection' play a role in the vocabulary of the evolutionary biologist similar to the word 'God' in ordinary language."[50]

Potential for designed adaptation

Nature is full of delightful novelty, as organisms interact and adapt to new conditions. Birds don't just build a nest; there are many kinds of nests. Spiders don't just build webs; there are numerous creative variants. Neurons in the brain are not static, nor are gene circuits in the cells. They are dynamic and are refined as the need arises.

The notion of change and adjustment are implicit in man's God-given authority over nature and duty to manage it wisely.[51]

Based on these comments, we propose that after the six days of direct creative activity, front-loaded information was made available, able to express itself at a later time in manifold ways in response to relevant triggers. A conceptual model is shown in figure 5. Initially (at creation, then after the Flood) a limited number of members within original kinds were present with considerable potential for variation. The diagram illustrates how new species could arise within the kind, die out or features converge, which would be easy if the necessary variety-enhancing information was present in different species.

Extra robustness is hypothesized to have been designed into proteins[52,53] so that a few mutations may be tolerated with no harm. Some variants may be maintained to ensure population robustness under new conditions, or developed by a few random mutations, or by exposure of front-loaded cryptic genetic instructions.

Over time various environmental niches (which include interaction with other adapting organisms) became populated. The genes not needed for a particular circumstance were deactivated, saving energy and material. Eventually, highly specialized organisms will lose the potential for further adaption to new environments and are less fit if made to compete with members in the preceding environment.[54] However, this loss of adaptability is slowed down by special features, such as the ability of microorganisms to recover genetic material from other species.[55–58]

Borger has emphasized the need for rapid change in biology, and proposed that VIGEs (variation-inducing genetic elements) are a designed feature to transfer genetic elements such as promoters, enhancers, binding sites, etc. to other locations, in addition to chromosomal rearrangements, leading to adaptations, new phenotypes and species.[59–62]

Behe's first rule of adaptive evolution

Michael Behe conducted a comprehensive study of reported adaptive mutations in viruses and bacteria[63] on the basis of what he called Functional Coded elemenTs (FCTs).

> "An FCT is a discrete but not necessarily contiguous region of a gene that, by means of its nucleotide sequence, influences the production, processing, or biological activity of a particular nucleic acid or protein, or its specific binding to another molecule. Examples of FCTs are: promoters; enhancers; insulators; Shine-Dalgarno sequences; tRNA genes; miRNA genes; protein coding sequences; organellar targeting—or localization signals; intron/extron splice sites; codons specifying the binding site of a protein for another molecule (such as its substrate, another protein, or a small allosteric regulator); codons specifying a processing site of a protein (such as a cleavage, myristoylation, or phosphorylation site); polyadenylation signals; and transcription and translation termination signals."

This is very interesting, since these elements are a combination of parameters and parameter values in cellular logic processing and relevant to Truman's Coded Information Systems (CIS) Theory discussed in part 4. Behe classified the benefit from a mutation as due to one of three causes: 1) Loss of FCT; 2) Gain of FCT; and 3) Modification of function. The latter is not caused by a loss or gain of a specific FCT. "It includes point mutations as well as other mutations that have a quantitative effect on a pre-existing FCT, increasing or decreasing its strength, for instance, or shifting its activity somewhat (such as allowing a protein to bind a structurally related ligand at the same site as its normal substrate)."[64]

Behe concluded that virtually all adaptive mutations are due to loss of modification of a pre-existing molecular function. "… snakes have lost legs, cavefish have lost vision, and the parasitic bacterium *Mycoplasma genitalium* has lost its ability to live independently in the wild, all in an effort to become better adapted to their environments."[65]

Outlook

In parts 2 and 3 of this series we will revisit the question of the origin of the three genes for enzymes E-I, E-II, and E-III. In part 3 we show that enzymes E-I to E-III are the result of small changes in the enzymatic region of activity and led to a minor modification of an existing function—simple catalytic hydrolysis of an amide bond. As discussed above, the chemical context around amide bonds is significantly variable among bio-chemical substances. The functional boundaries for E-I to E-III enzymes can be viewed to lie, with easily attained modification, within the range of activity for which they were intended to work.

Given the existence of very large bacterial populations carrying suitable predecessors for these three enzymes, and the built-in adaptability provided to bacteria to serve their environmental recycling duties, degradation of man-made synthetic materials with virtually identical functional groups as the usual target poses no difficulty to a creation scientist. It is statistically very likely that microorganisms will often be available with rearranged genomes able to adapt immediately to a new environmental challenge.

Coded Information Systems (CIS)

In contrast to the code of (micro) organisms, computer code is deterministic (even when elements of randomness are programmed in). In the code of life there is no complete blueprint in DNA, which specifies all possible biological outcomes. Adaptability of organisms can be understood by reflecting on how message-enhanced instructions work in biology. A separate gene was not created to degrade each unique protein. Instead, enzymes exist which are able to identify a single functional group or feature that can appear in thousands of proteins, even though the alternative chemical contexts may be very different (due to their location within folded proteins, attachment of other chemical groups, and so on).

Different enzyme variants are generally needed for a *category of problem*. Minor changes in existing enzymes could improve performance in special cases.

In part 4 we point out that flexible designs, pre-planned to respond to alternative parameters, offer an alternative to multiple dedicated programs but can be more efficient in usage of matter, energy, and maintenance. No new source of information created enzymes E-I, E-II, and E-III. Producing a variant of a general-purpose enzyme class designed to provide nutrients was facilitated by designing high populations of adaptable bacteria with very slow rates of mutation. In other words, an optimization algorithm had been set up.

Conclusion

Several species of bacteria can degrade waste materials generated during the production of nylon-6. Three kinds of enzymes are used to cleave amide bonds, which are a functional group present in many kinds of bio-chemicals. We pointed out that bacteria must play important roles in ever-changing ecologies, and we view God's creative design as deliberately incorporating the necessary degree of anticipatory adaptability. It would be an incompetent God indeed who would need to prepare a separate gene for every possible amide variant. Instead, a collection of similar genes perform part of the recycling of substances by focusing of a a problem category, hydrolysing amide bonds *per se*.

New discoveries suggest the ability of bacteria to degrade newly produced synthetic substances should not be so surprising. Resistance to modern man-made antibiotics is a common trait in ancient microorganisms, demonstrating this resistance did not evolve recently. As an example, resistant bacteria have been recovered from Greenland deep ice sheet, Antarctica, and other permafrost environments.[66]

Small fine-tuning of an existing class of enzymatic function is not an example of the kinds of macro-evolutionary innovations required by evolutionists. What would be necessary to provide support for macro-evolution are examples of true novelty, which typically demand multiple new gene families simultaneously, to produce molecular machines and other complex features.

In part 2 we will review Ohno's popular theory that *de novo* genes arose via frameshift mutations,[67] and show that there are good statistical reasons to reject this hypothesis. The theory is worth examining in depth, since Ohno popularized the notion of genes having originated from much simpler oligomeric DNA repeat sequences,[68] and his theory is often mistakenly quoted as fact, based on these 'nylon-eating bacteria'.

In part 3 we review the work by Negoro,[69] who showed that these amide-hydrolysing genes arose easily from existing predecessors, which discredited Ohno's theory.

In part 4 we use CIS (Coded Information Systems) Theory to interpret the existence of the three modified enzymes.

References

1. Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K. and Watson J.D., *Molecular Biology of The Cell*, 3rd edn, Garland Publishing, New York, 1994.
2. French, D.L., Laskov, R. and Scharff, M.D., The role of somatic hypermutation in the generation of antibody diversity, *Science* **244**:1152–1157, 1989.
3. Tomlinson, I.M., Cox, J.P., Gherardi, E., Lesk, A.M. and Chothia, C., The structural repertoire of the human V kappa domain, *EMBO J.* **14**(18): 4628–4638, 1995.
4. Lin, M-Q.L., Zhu, M. and Scharff, M.D., Sequence dependent hypermutation of the immunoglobulin heavy chain in cultured B cells, *Proc. Natl. Acad. Sci. USA* **94**:5284–5289, 1997.
5. Schatz, D.G., Oettinger, M.A. and Schlüssel, M.S., V(D)J recombination: molecular biology and regulation, *Annu Rev Immunol.* **10**:359–383, 1992.
6. Truman, R., The Unsuitability of B-Cell Maturation as an Analogy for Neo-Darwinian Theory, www.trueorigin.org/b_cell_maturation.asp.
7. Chakrabarty, A.M., Plasmids in *Pseudomonas*, *Annu. Rev. Genet.* **10**:7–30, 1976.
8. Kinoshita, S., Kageyama, S., IBA, K., Yamada, Y. and Okada, H., Utilization of a cyclic dieter and linear oligomers of ε-aminocaproic acid by *Achromobacter guttatus* KI 72, *Agr. Biol. Chem.* **39**(6):1219–1223, 1975.
9. Current proposed taxonomy of K172, www.uniprot.org/taxonomy/261.
10. Kinoshita *et al.*, ref. 8, p. 1222.
11. Kinoshita, S., Negoro, S., Muramatsu, M., Bisaria, V. S., Sawada S. and Okada, H., 6-aminohexanoic acid cyclic dimer hydrolase. A new cyclic amide hydrolase produced by *Acromobacter guttatus* K172, *Eur. J. Biochem.* **80**: 489–495, 1977.
12. Kinoshita *et al.*, ref. 11, p. 495.
13. Negoro, S., Shinagawa, H., Nakata, A., Kinoshita, S., Hatozaki, T. and Okada, H., Plasmid control of 6-aminohexanoic acid cyclic dimer degradation enzymes of *Flavobacterium* sp. K172, *J. Bacteriol.* **143**(1):238–245, 1980.
14. Kanagawa, K., Oishi, M., Negoro, S., Urabe, I. and Okada, H., Characterization of the 6-aminohexanoate-dimer hydrolase from *Pseudomonas* sp. NK87, *J. Gen. Microbiol.* **139**:787–795, 1993.
15. Kanagawa, K., Negoro, S., Takada, N. and Okada, H., Plasmid dependence of *Pseudomonas* sp. strain NK87 enzymes that degrade 6-aminohexanoate-cyclic dimer, *J. Bacteriol.* **171**:3181–3186, 1989.
16. Kinoshita, S., Terada, T., Taniguchi, T., Yukio T., Masuda, S., Matsunaga, N. and Okada, H., Purification and characterization of 6-aminohexanoic-acid-oligomer hydrolase of *Flavobacterium* sp. K172, *Eur. J. Biochem.* **116**: 547–551, 1981.
17. Kinoshita *et al.*, ref. 16, p. 551.
18. Negoro, S., Taniguchi, T., Kanaoka, M., Kimura, H. and Okada, H., Plasmid-Determined Enzymatic Degradation of Nylon Oligomers, *J. Bacteriol.* **155**(1):22–31, 1983.
19. Negoro *et al.*, ref. 18, p. 25.

20. Negoro *et al*., ref. 18, p. 28.
21. Kanagawa *et al*, ref. 14, p. 787. "The *P-EII enzyme* was purified from an *Escherichia coli* clone in which the *P-EII gene* was highly expressed. The *P-EII enzyme* was inhibited by a serine protease inhibitor, diisopropyl fluorophosphate, as was the *F-EII enzyme*." We illustrate here that the same abbreviation, such as *P-EII*, was sometimes used for the gene and sometimes for the gene product. Complicating the discussion, different abbreviations for the genes were used by different authors or the same ones over time. We tried to retain the original nomenclature where possible while modifying where necessary to avoid confusion.
22. Kanagawa *et al.*, ref. 14, p. 792.
23. Negoro, S., Biodegradation of nylon oligomers, *Appl. Microbiol. Biotechnol.* **54**: 461–466, 2000.
24. Negoro, S., Kakudo, S., Urabe, I. and Okada, H., A new nylon oligomer degradation gene (nylC) on plasmid pOAD2 of *Flavobacterium* sp. strain K1725, *J. Bacteriol.* **174**:7948–7953, 1992.
25. Negoro, ref. 23, p. 462.
26. Kakudo, S., Negoro, S., Urabe, I. and Okada, H., Nylon oligomer degradation gene, *nylC*, on plasmid pOAD2 from a *Flavobacterium* strain encodes endo-type 6-aminohexanoate oligomer hydrolase: purification and characterization of the *nylC* gene product, *Appl. Envir. Microbiol.* **59**(11):3978–3980, 1993.
27. Prijambada, I.D., Negoro, S., Yomo, T. and Urabe, I., Emergence of nylon oligomer degradation enzymes in *Pseudomonas aeruginosa* PAO through experimental evolution, *Appl. Envir. Microbiol.* **61**(5):2020–2022, 1995.
28. Rosenberg, S.M., Longerich, S., Gee, P. and Harris, R.S., Adaptive mutation by deletions in small mononucleotide repeats, *Science* **265**:405–407, 1994.
29. Harris, R.S., Longerich, S. and Rosenberg, S.M., Recombination in adaptive mutation, *Science* **264**:258–260, 1994.
30. Lenski, R.E. and Mittler J.E., The directed mutation controversy and neo-Darwinism, *Science* **259**:188–194, 1993.
31. Prijambada *et al*., ref. 27, p. 2021.
32. Yasuhira, K., Tanaka, Y., Shibata, H., Kawashima, Y., Ohara, A., Kato, D., Takeo, M. and Negoro, S., 6-Aminohexanoate oligomer hydrolases from the alkalophilic bacteria *Agromyces* sp. strain KY5R and *Kocuria* sp. strain KY2, *Appl. Envir. Microbiol.* **73**(21):7099–7102, 2007.
33. Yasuhira *et al.*, ref. 32, p. 7100.
34. Yasuhira *et al.*, ref. 32, p. 7101.
35. Negoro, A., Shibata, N., Tanaka, Y., Yasuhira, K., Shibata, H., Hashimoto, H., Lee, Y-H., Oshima, S., Santa, R., Oshima, S., Mochiji, K., Goto, Y., Ikegami, T., Nagai, K., Kato, D., Takeo, M. and Higuchi, Y., Three-dimensional structure of nylon hydrolase and mechanism of nylon-6-hydrolysis, *J. Biol. Chem.* **287**:5079–5090, 2012.
36. The Shine-Dalgarno sequence on prokaryotic mRNA is located around 8 bases upstream of the start codon and helps recruit the ribosome to the mRNA to initiate protein synthesis by aligning it with the start codon, en.wikipedia.org/wiki/Shine-Dalgarno_sequence.
37. Negoro *et al*., ref. 35, p. 5080.
38. Negoro *et al*., ref. 35, p. 5088.
39. Batten, D., The adaptation of bacteria to feeding on nylon waste, *J. Creation* **17**(3): 3–5, 2003.
40. Kato, K., Ohtsuki, K., Koda, Y., Maekawa, T., Yomo, T. Negoro, S. and Urabe, I., A plasmid encoding enzymes for nylon oligomer degradation: nucleotide sequence and analysis of pOAD2, *Microbiology* **141**:2585–2590, 1995.
41. Negoro, ref. 23, p. 463.
42. Negoro *et al*., ref. 24, p. 7950.
43. An Interview with Dr. Michael J. Behe, www.ideacenter.org/contentmgr/showdetails.php/id/1449, accessed 18 May 2014.
44. Negoro, ref. 23, p. 465.
45. Drake, J.W., Charlesworth, B., Charlesworth, D. and Crow, J.F., Rates of Spontaneous Mutation, *Genetics* **148**:1667–1686, 1998.
46. Negoro *et al*., ref. 24, p. 7948.
47. Anderson, K.L. and Purdom, G., A Creationist Perspective of Beneficial Mutations in Bacteria, *Proceedings of the Sixth International Conference on Creationism*, pp. 73–86 (2008); answersingenesis.org/genetics/mutations/a-creationist-perspective-of-beneficial-mutations-in-bacteria/.
48. Truman, R. and Borger, P., Genome truncation vs mutational opportunity: can new genes arise via gene duplication?—part 1, *J. Creation* **22**(1):99–110, 2008.
49. Truman, R. and Borger, P., Genome truncation vs mutational opportunity: can new genes arise via gene duplication?—part 2, *J. Creation* **22**(1):111–119, 2008.
50. Gatlin L.L., *Information theory and the living system*, Columbia University Press, New York, p. 164, 1972.
51. Genesis 1:26; Genesis 1:28; Genesis 2:15.
52. Axe, D., Extreme functional sensitivity to conservative amino acid changes on enzyme exteriors, *J. Molec. Biol.* **301**:585.595, 2000.
53. Axe, D.D., Estimating the Prevalence of Protein Sequences Adopting Functional Enzyme Folds, *J. Molec. Biol.* **341**:1295–1315, 2004.
54. Cooper, V.S., Bennett, A.F. and Lenski, R.E., Evolution of thermal dependence of growth rate of Escherichia coli populations during 20,000 generations in a constant environment, *Evolution* **55**:889–896, 2001.
55. Via conjugation: en.wikipedia.org/wiki/Bacterial_conjugation.
56. Via sexduction: www.cliffsnotes.com/sciences/biology/microbiology/microbial-genetics/bacterial-recombinations.
57. Via transduction: en.wikipedia.org/wiki/Transduction_(genetics).
58. Via transformation: en.wikipedia.org/wiki/Transformation_(genetics).
59. Borger, P., Evidence of the design of life: part 1—genetic redundancy, *J. Creation* **22**(2):79–84, 2008; creation.com/genetic-redundancy.
60. Borger, P., Evidence of the design of life: part 2—baranomes, *J. Creation* **22**(3): 68–76, 2008; creation.com/baranomes-and-the-design-of-life.
61. Borger, P., The design of life: part 3—an introduction to variation-inducing genetic elements, *J. Creation* **23**(1):99–106, 2009; creation.com/vige-introduction.
62. Borger, P., The design of life: part 4—variation-inducing genetic elements and their function, *J. Creation* **23**(1):107–114, 2009; creation.com/vige-function.
63. Behe, M.J., Experimental evolution, loss-of-function mutations, and 'the first rule of adaptive evolution', *The Quarterly Review of Biology* **85**(4):419–45, 2010.
64. Behe, ref. 63, p. 421.
65. Behe, ref. 63, p. 420.
66. Zhang, X.F., Yao, T.D., Xu, S.J. and An, L.Z., Phylogenetic and physiological diversity of microorganisms isolated from Puruogangri ice core, *Microbiol. Ecol.* **55**:476–488, 2008.
67. Ohno, S., Birth of a unique enzyme from an alternative reading frame of the pre-existed, internally repetitious coding sequence, *Proc. Natl. Acad. Sci. USA* **81**:2421–2425, 1984.
68. Ohno, S. and Epplen, J.T., The primitive code and repeats of base oligomers as the primordial protein-encoding sequence, *Proc. Natl. Acad. Sci. U.S.A.* **80**: 3391–3395, 1983.
69. Negoro, S., Ohki, T., Shibata, N., Mizuno, N., Wakitani, Y., Tsurukame, J., Matsumoto, K., Kawamoto, I., Takeo, M. and Higuchi, Y., X-ray Crystallographic analysis of 6-aminohexanoate-dimer hydrolase: molecular basis for the birth of a nylon oligomer-degradation enzyme, *J. Biol. Chem.* **280**:39644–39652, 2005.

Royal Truman *has bachelor's degrees in chemistry and in computer science from State University of New York; an MBA from the University of Michigan (Ann Arbor); a Ph.D. in organic chemistry from Michigan State University; and a two-year post-graduate 'Fortbildung' in bioinformatic from the Universities of Mannheim and Heidelberg. He works in Germany for a European-based multinational.*

The Sedimentary Heavitree Quartzite, Central Australia, was deposited early in Noah's Flood

Tas Walker

A detailed study of the sedimentary structure and geographical extent of a prominent and widespread sandstone unit in central Australia reveals evidence of high energy depositional processes. The sheet-like nature of the Heavitree Quartzite indicates that an abundant supply of sediment was deposited and distributed in a high-energy, shelf-like environment. The extent of the sedimentary formation indicates that the depositional process represented a cataclysm of continental scale. Abundant sediment supply was transported to the flat, shallow depositional basin by wide flowing rivers. The sediments were laid down rapidly throughout the basin by high-energy water flows associated with the shallow marine environment of the basin, and by rapid changes in relative sea level. In the early stages of deposition strong reversing tidal currents played a major role in dispersal, but as water depths increased unidirectional currents became dominant. These findings from sedimentological analysis are indicative of the types of depositional environments expected during the early phase of Noah's Flood.

Oxides of iron give central Australia its distinctive reddish hue. Because vegetation is sparse, rocky strata are visible in the cliffs of the MacDonnell Ranges, which run for hundreds of kilometres across the 'Centre' (figure 1). These geological features of central Australia reveal compelling evidence of the global Flood catastrophe of Noah's day.

Internal sandstone structure indicates catastrophic deposition

One impressive feature is a quartz-sandstone formation in the prominent ridges of the MacDonnell Ranges, called the Heavitree Quartzite (figure 2). This formation is composed mostly of quartz sand, with white and tan grains cemented into very hard rock by silica cement.

Where the Heavitree Quartzite is exposed in cliffs and gorges it often shows prominent layers. The strata are usually dipping, having been tilted by tectonic activity. Within each of these strata it is usually possible to see fainter lines running at an angle.[1] This 'cross-bedding' forms when sand is deposited by flowing water, somewhat similar to the way moving water creates sand ripples on a beach. The ripples move sideways with the water leaving the pattern of cross-bedding as the sediment accumulates.

Figure 3 illustrates how cross-beds form, with the water flow carrying the sediment into the area and dropping it onto the front of the sloping sand surface, forming 'foresets'. The foresets face the direction of the water flow, and from their height and shape the speed and depth of the water may be inferred.

Geologist John Lindsay described the bedding in the lower portion of the Heavitree Quartzite, a portion he calls 'Sequence 1'.[2] In the middle of his photograph[3] (figure 4) the typical large-scale foresets (labelled 'A') are visible with the cross-beds dipping downward toward the left, indicating water flow from the right. The cross-beds are of sigmoidal shape (i.e. slightly curved like an 'S') but the top part of the sigmoidal cross-beds has been cut off by a thinner bed of flat-lying sandstone (labelled 'B'). There is a similar thinner bed beneath the cross-beds (also labelled 'B').

Lindsay also published a diagram to illustrate the internal features of the quartzite beds (figure 5). It shows three beds with the typical sigmoidal foresets, with the top and bottom examples being 1 m thick. This thickness points to a significant depth of flowing water carrying abundant sand into the area and depositing it. Lindsay describes the flow direction as unidirectional and well defined.[3]

On the middle bed of his diagram (figure 5) Lindsay indicates that beds can be up to 10 m thick. Typically, when cross-beds become larger than a metre or two mainstream geologists have difficulty interpreting how the sediments were deposited. The reason is philosophical. With a uniformitarian bias, they aim to explain past geology in terms of a modern environment. However, enormous water flows depositing huge volumes of sand over large areas are not observed today. Consequently, mainstream geologists speak of "the uncertainty about the details of their depositional setting", or that the setting is "not well understood".[4]

One of the standard responses is to interpret cross-bedded deposits as wind-blown (aeolian) because large sand dunes are observed to form in desert environments today. However, these foreset beds are truncated by thin flat beds, and they also grade laterally into plane-bedded sandstones (figure 5).

The internal shape of a sedimentary bed depends on a number of factors such as grain size and flow velocity. As

image: iStockphoto/keithwheat

Figure 1. Portion of the MacDonnell Ranges in central Australia.

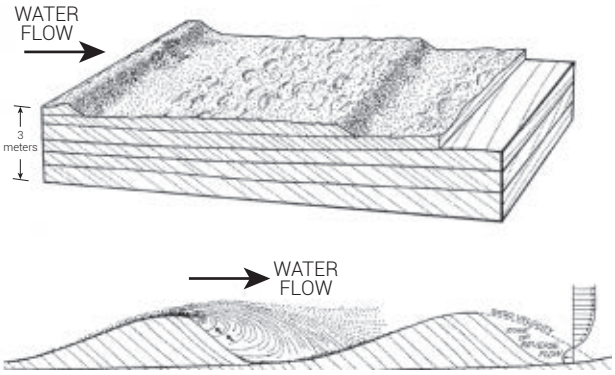


Figure 3. Diagram illustrating how cross-beds form in strata as sediment is deposited from flowing water. Lower image has vertical exaggeration.

the flow velocity increases, the beds change from angular cross-beds to flat-beds, a bedform described as 'upper flat-beds', where 'upper' refers to high velocity. Figure 5 shows that the top of the middle cross-bed is truncated by a flat-bed, indicating that both bedforms were deposited by water, and that the flow was strong. This means that there was a significant depth of fast-flowing water depositing these beds.

Figure 5 illustrates another feature of the sandstone deposits. The middle row of foresets, toward the left-hand side, shows the sigmoidal shape changing into 'recumbent foresets'. This indicates that the water flow (coming from the right to the left) was so strong that the sand dunes were 'bent' backwards by an "intense shear stress generated by the high velocity currents".[3]

From his observation and analysis of the sedimentary structures of the sandstone, Lindsay[5] concluded that the Heavitree Quartzite formed from wide flowing rivers delivering an abundant supply of sediment into a huge, flat, shallow depositional basin. The basin was subsiding relative to the water level, and the sediment delivered was readily dispersed throughout the basin because of the high-energy water currents associated with the shallow marine environment of the basin and by major changes in relative sea level. In the early stages of deposition strong reversing tidal currents played a major role in dispersal, but as water depths increased, unidirectional currents became dominant. Lindsay's description graphically pictures the sort of environment that we would anticipate early in the Noahic Flood. With this magnitude of energy involved in the delivery and dispersal of the sediments, we would also expect the flows of water to impact a large geographical extent, and this is what geologists have discovered.

Huge geographical extent

The Heavitree Quartzite covers a large area, being the basal deposit within the Amadeus Basin, which lies in the middle of the Australian continental block; a basin

image: iStockphoto/greenantphoto

Figure 2. Exposures of Heavitree Quartzite in Ormiston Gorge, central Australia.

image:Lindsay

Figure 4. Typical exposure of Heavitree Quartzite showing bedding. A: Bed shows typical large-scale foresets with the cross-beds dipping downward toward the left at approximately 20°. B: Thinner beds are plane beds. (Photo from Lindsay.[3])

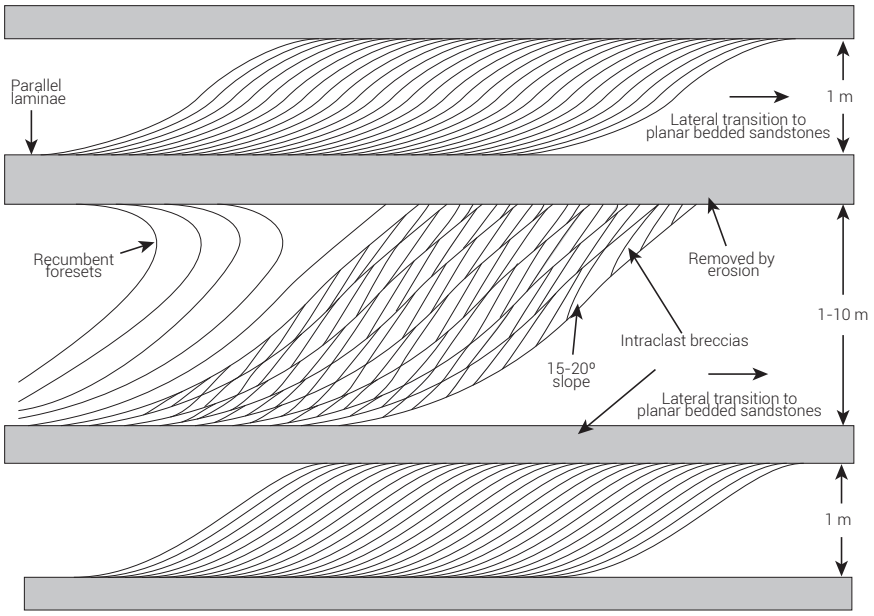


Figure 5. Simplified diagram illustrating the internal structure of the Heavitree Quartzite showing cross-bedded beds and plane beds (from Lindsay[3]).

that is 850 km long from east to west, and 250 km wide (figure 6). The Heavitree Quartzite covers an area of some 158,000 km^2.[6]

Figure 7 shows a geological cross-section of part of the Amadeus Basin from north to south. The Heavitree Quartzite is the earliest sedimentary formation deposited in the basin, being the basal unit deposited over the unassigned crystalline basement. Uplift has exposed the quartzite formation in extensive outcrops along the north side of the Amadeus Basin, where it forms prominent ridges in the MacDonnell Ranges. Outcrops are almost continuous across the basin, from west to east—i.e. from the Western Australian border to the Simpson Desert.

Figure 6. The Amadeus Basin in central Australia.

Even though the Heavitree Quartzite is 1,000 m thick, its large geographical extent means that it has an "unusually thin sheet-like geometry".[4] This is a mystery for the geologist who seeks to explain past geological features by processes that are observable today. In modern environments sediments are not seen to be deposited with this geometry. Shallow marine currents do not have sufficient energy to disperse such a huge volume of sediment so rapidly over such a large area.[4] However, this sort of geometry is consistent with high-energy deposition, and this is what is expected in the global cataclysm of Noah's Flood.[7]

The Centralian Superbasin

Not only is the thick, geographically extensive quartzose sandstone prominent in the Amadeus Basin, but the same type of sandstone units are present in neighbouring sedimentary basins of a corresponding geologic 'age'. This indicates that the geographical extent of the watery catastrophe reached far beyond the Amadeus Basin.

Figure 8 shows the location of sedimentary basins outcropping in central Australia with similar assigned ages. These are the Amadeus Basin, Officer Basin, Ngalia Basin, Wolfe Basin, Georgina Basin, and the Adelaide Geosyncline. The Warburton Basin is a subsurface basin also considered to be of the same age.

The sedimentary unit at the base of each of these basins is a thick, laterally persistent quartzose sandstone with a sheet-like geometry.[4] Stratigraphic equivalents to the Heavitree Quartzite have been given different names in different basins, and occasionally in different parts of the same basin. Lindsay sets these equivalent names in a table reproduced as figure 9, and indicates the geographical extent of this unit on the map, shown in figure 10. The broad geographical extent of these sedimentary units has led some geologists to refer to this region as the Centralian Superbasin,[8] a basin that encompasses all the basins of the region. Geologists have suggested that these sandstone units were related to basin dynamics, being the first units deposited following widespread basin subsidence.

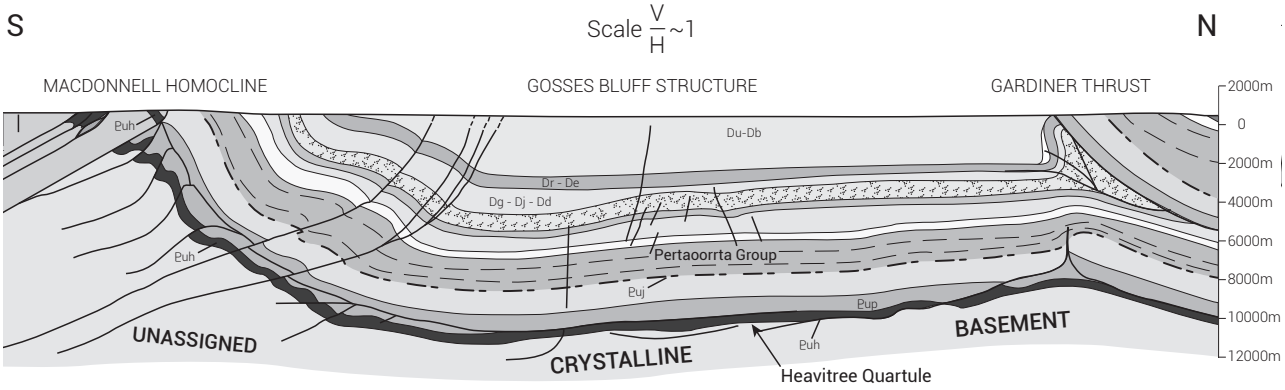


Figure 7. South–North cross-section through portion of the Amadeus Basin. Width of section is N 60km Heavitree Quartzite is shown black (after 1:250,000 geological map SF 53-13 Hermannsburg[14]).

Timing within biblical history

The characteristics of the aforementioned quartzose sandstone units are different from what would be expected if the quartzites were deposited by processes similar to what is observable today. Stratigrapher Andrew Miall reaches the same conclusion:

> "We need a new approach to uniformitarianism, because of the disconnect … between those working on the modern and the ancient record. It could be argued that the analog method on which modern sedimentology is based, is no longer a satisfactory foundation for research into long-term geological processes."[9]

The problem for modern sedimentologists is that they ignore the most important factor in the formation of the ancient record, namely Noah's Flood. The Heavitree Quartzite is consistent with that event.

Some biblical geologists suggest that Neoproterozoic deposits such as these represent the very first deposits of the Flood, forming as a result of the breakup of the fountains of the great deep (Genesis 7:11).[10] The Heavitree formation may have formed as great rainfall early in Noah's Flood caused immense erosion of pre-Flood continents.

Others have proposed that the pre-Flood boundary is geologically much lower, even at the base of the transition zone in the earth's mantle.[11] With a lower boundary, the crystalline basement on which the Heavitree Quartzite is deposited, as shown in the geological cross-section (figure 7), would have formed earlier in the Flood, and its erosion provided the material comprising the Heavitree Quartzite. One argument for a lower boundary relates to the massive igneous activity associated with deposits earlier than Neoproterozoic, such as granitic plutons, basaltic intrusions, high-temperature komatiites, and enormous igneous dykes. According to the historical record in Genesis, six times during Creation Week, the creation was described as 'good'

Figure 8. Location of sedimentary basins in central Australia with assigned ages from Neoproterozoic to Early Palaeozoic, within the evolutionary timeframe. This would be equivalent to early Flood deposits within the biblical timeframe (after Lindsay[8]).

(Genesis 1:4, 10, 12, 18, 21, 25). At the end of the sixth day, when creation was finished, God described the whole of creation as 'very good' (v. 31). Hot lavas, voluminous and cataclysmic, releasing ash and noxious gases into the atmosphere do not give the impression of being 'very good', and consequently should not be assigned to Creation Week. In this view it would be more likely that they erupted early during the Flood.[12] A lower pre-Flood boundary would mean that although the Heavitree Quartzite would have been deposited early in the Flood it would not have been at the very beginning of the Eruptive phase.[13]

Either way, the Flood provides the key.

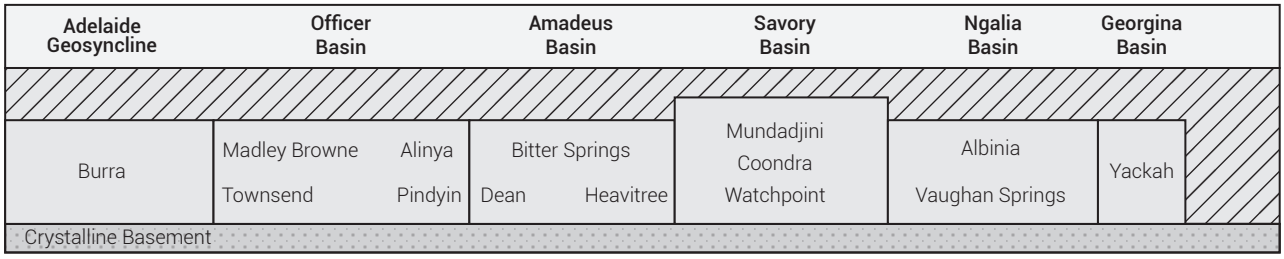


Figure 9. Regional correlation of the bottom sedimentary units across the sedimentary basins of central Australia (after Lindsay[8]).

Figure 10. Distribution of the Heavitree Quartzite and corresponding basal quartzose sandstone units in central Australia. Possible larger extent of distribution is shown with dotted line (after Lindsay[8]).

Conclusion

The Heavitree Quartzite and its thick stratigraphic equivalents in neighbouring sedimentary basins provide powerful evidence of high-energy watery environments that rapidly deposited abundant quartzose sediment over a widespread area of what is now central Australia. This occurred prior to the deposition of the fossil-bearing sediments of the Phanerozoic. The characteristics of the deposit reflect processes having far greater energy than the sorts of processes observable today, which is inconsistent with the principle of uniformitarianism. However, the characteristics of the deposit are consistent with what is expected from Noah's Flood, with the deposits forming early during that global event.

References

1. In the Heavitree Quartzite the cross-bedding is often masked by a silica mineral that has cemented the grains of sand together.
2. Lindsay, J.F., Heavitree Quartzite, a Neoproterozoic (Ca 800–760 Ma), high-energy, tidally influenced, ramp association, Amadeus Basin, central Australia, *Australian J. Earth Sciences* **46:**127–139, 1999.
3. Lindsay, ref. 2, p. 133.
4. Lindsay, ref. 2, p. 127.
5. Lindsay, ref. 2, p. 137.
6. Lindsay, ref. 2, pp. 129–130.
7. Walker, T., Sedimentary blankets: Visual evidence for vast continental flooding, *Creation* **32**(4):50–51, 2010.
8. Lindsay, ref. 2, p. 128.
9. Miall, A., *Fluvial Depositional Systems*, Springer Geology, Springer International Publishing, Switzerland, 2014; DOI: 10.1007/978-3-319-00666-6_1.
10. Dickens, H. and Snelling, A.A., Precambrian geology and the Bible: a harmony, *J. Creation* **22**(1):65–72, 2008; creation.com/images/pdfs/tj/j22_1/j22_1_65-72.pdf .
11. Hunter, M.J., The pre-Flood/Flood boundary at the base of the earth's transition zone, *J. Creation* **14**(1):60–74, 2000; creation.com/the-pre-flood-flood-boundary-at-the-base-of-the-earths-transition-zone.
12. Volcanoes during Creation Week, Letters to the editor by Esperante, R. and Walker, T., *J. Creation* **22**(1):50–52, 2008; creation.com/images/pdfs/tj/j22_1/j22_1_50-52.pdf .
13. Walker, T.B., A Biblical geologic model; in: *Proceedings of the Third International Conference on Creationism*, Walsh, R.E. (Ed.), Creation Science Fellowship, Pittsburgh, PA, pp. 581–592, 1994.
14. Shaw, R.D. and Warren, R.G., *Hermannsburg (1:250,000 scale geological map)*, Australian Geological Survey, Canberra, 1995.

Tasman Walker, *B.Sc. (Earth Science with hons), B.Eng. (Mechanical with hons), and Ph.D. (mechanical engineering), worked to plan, design and operate power stations for over 20 years, including geological assessments of coal supplies. Tas also worked to plan a large hydro-electric project including evaluation of geological conditions and their effect on dams, etc. Tas has authored many articles in* Creation *and* Journal of Creation *and is a researcher, writer and speaker with CMI, Australia.*

What life isn't

Alex Williams

Astrobiologists claim there are only three prerequisites for life—organic molecules, water, and energy. But Earth life can sustain itself indefinitely only in communities based on primary producers—specialized organisms that can manufacture their own food from the energy contained in sunlight, inorganic chemicals, or electrons. In any naturalistic scenario such specialized primordial cells must have formed in water because all functioning cells require more water than all other ingredients combined. However, the thermal properties of liquid water are so destructive on the molecular scale (briefly violating the 2nd Law of Thermodynamics) that life could never have originated merely from organic chemicals, water, and energy. Water therefore defines life, not in the positive sense of what it *is*, but in the negative sense of what it *isn't* and could *never be*—a product of nature. Water's destructive power sets such high standards for cell design, construction, functionality, and time scale—just a minuscule fraction of a second—that it excludes all naturalistic scenarios. Genesis-style fiat creation remains the only rational explanation.

Astrobiologists from Cornell University have recently claimed there are just three prerequisites for life—organic molecules, water, and energy. Since all three occur throughout the universe, they went on to calculate that about 100 million planets in our galaxy could harbour complex life, ecosystems, and biospheres.[1] But for over 60 years now scientists have been doing experiments with organic molecules, water, and energy, and they have produced nothing other than chemistry. Biology clearly requires more than chemistry.

Harvard University's Nobel prize-winning origin-of-life researcher Jack Szostak admits that *cells* are the essential prerequisite for life:

> "We're looking at a very narrow slice of the whole problem. We assume we have the chemical building blocks of life: the question we're looking at is what do we need to do to make these chemicals get together and work like a cell?"[2]

Another Nobel prize-winning biochemist, Christian de Duve, identified intelligent design as one of seven possible origin scenarios.[3] He rightly pointed out that this possibility can only be entertained if all naturalistic causes are excluded,[4] and he took comfort in the thought that naturalistic causes could *never* be exhaustively ruled out. In this article, however, I use the thermal properties of water to demonstrate that natural causes can be ruled out with great certainty, leaving Genesis-style fiat creation as the only rational explanation.

What is Life?

The Cornell astrobiologists' calculations were based upon a faulty understanding of biology. Other astrobiologists have recognized that "a general theory of living systems" is an essential prerequisite for knowing what life is.[5] Nobel prize-winning physicist Erwin Schrödinger addressed this question in his 1944 book *What is Life*?[6]

> "What is the characteristic feature of life? When is a piece of matter said to be alive? When it goes on 'doing something', moving, exchanging material with its environment, and so forth, and that for a much longer period than we would expect an inanimate piece of matter to 'keep going' under similar circumstances. When a system that is not alive is isolated or placed in a uniform environment, all motion usually comes to a standstill very soon as a result of various kinds of friction; differences of electric or chemical potential are equalized, substances which tend to form a chemical compound do so, temperature becomes uniform by heat conduction. … The physicist calls this the state of thermodynamical equilibrium, or of 'maximum entropy'. Practically, a state of this kind is usually reached very rapidly."[7]

Life, according to Schrödinger, is that which sustainably *avoids* such rapid return to equilibrium.

You can see something of what he is talking about in this home experiment. Pour a teaspoon of soy sauce into the middle of a shallow bowl of water. A furious reaction takes place. The water molecules attack the sauce droplet and the sauce is scattered in all directions. Come back a short while later and the mixture will be uniformly quiet—it has 'decayed to equilibrium'.

The energy that powers this reaction is called 'thermal energy.'[8] Free water molecules always race around at supersonic speeds because of their thermal energy. We don't normally notice it because they quickly encounter other water molecules doing the same thing, bouncing off each other, jiggling about a lot, and ending up as a 'sea of thermal noise'. Thermal noise is the 'dance' that all kinds of molecules engage in when nothing else is happening. Water

always wins the battle against soy sauce, however, because its molecules are smaller, faster, and vastly more numerous than the larger and slower organic molecules in the sauce.

So how does life avoid this kind of decay to equilibrium? Schrödinger used the laws of physics to define three conditions:

- Cellular machinery operates at a scale where thermal noise interferes, so it must have some means of overcoming this.
- The primary means must be through strong chemical bonds.
- To remain operational over a long timescale ('indefinitely' is a suitable term that covers the history of life on Earth) life must have a means—which he simply called 'metabolism'—of feeding upon 'negative entropy' in the environment.

Schrödinger was the first person to develop the concept that life operates within a sea of thermal noise.[9] Few, if any, seem to have subsequently realized the enormous significance that it has in biology. Recently, however, improvements in technology have allowed us to watch life at work in molecular detail, and suddenly there it is before our eyes! It now gives us an extremely powerful way of answering the question "What is Life?" because it clearly defines what life is *not* and can *never be*.

The molecular heat storm

Thermal noise is heat. Heat is not a substance that resides in hot objects and can be passed on to cold objects. Heat is the motion of atoms and molecules. If a thermometer says it is 20°C outside, it means air molecules are impacting on it at about 1,840 km per hour. That's around 50% faster than the speed of sound.[10] At the bottom of the temperature scale all heat motion stops at –273.15°C, also known as zero on the absolute temperature scale. That's colder than intergalactic space, where the temperature is around –270°C, and hydrogen gas molecules race around at about 700 km per hour. In comparison, life as we know it is quite 'hot'. It usually exists within a temperature range of 0° to 100°C because it requires liquid water. In the narrower range, where most organisms live (5–40°C), the average speed of a water molecule is about 2,300 km/hour. That's almost twice the speed of sound!

Here is what the 'heat storm' looks like at the biomolecular level. Figure 1A shows a model of a common molecular machine found inside bacterial cells (a ribosome 30S subunit) at single-atom resolution.

This is what the molecular machine might look like at absolute zero temperature. At 4°C the atoms are moving too fast to see and the image is smeared out (figure 1B). At 18°C even less detail is visible (figure 1C), and at 37°C—the internal temperature of the human body—it looks like the machine is flying apart (figure 1D). This is partly true—at slightly higher temperatures many cells (including our own) die from overheating—but it also reflects the inability of the imaging system to capture the incredibly fast action. This is what the heat storm looks like in a molecular machine!

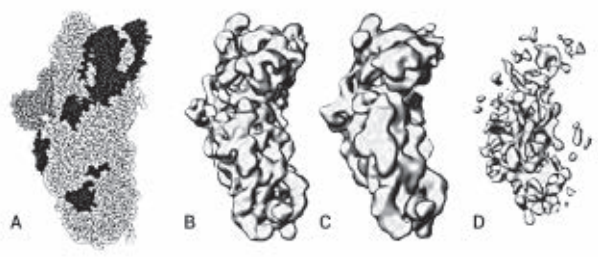


Figure 1. Molecular images of the 30S subunit of a bacterial ribosome. A—atomic model showing where each atom is and the space it fills.[11] B—electron microscope image taken at 4°C; heat motion obscures the individual atoms. C—at 18°C heat motion obscures even more of the atomic detail. D—at 37°C heat motion is too fast for the camera to capture.[12]

Brownian motion

The earliest physical evidence of the molecular heat storm was published in 1828 by Scottish botanist Robert Brown.[13] While studying live plant cells under a light microscope he noticed that tiny particles were incessantly jiggling. Even when the cells were killed the jiggling continued. On further investigation he found that any kind of tiny solid particles suspended in liquid also engaged in similar random jiggling (figure 2). It has since become known as 'Brownian motion'. Today it remains a constant problem in studying bacteria—they have to be 'fixed' onto glass slides to *stop* the jiggling!

Albert Einstein published a theory in 1905 explaining Brownian motion as the result of the molecular heat storm. He calculated that

> "... according to the molecular-kinetic theory of heat, bodies of microscopically visible size suspended in liquids must, as a result of thermal molecular motions, perform motions of such magnitude that these motions can easily be detected by a microscope."[14]

If his theory turned out to be true, he noted, then it would also demonstrate that "classical thermodynamics [could] no longer be viewed as strictly valid". Einstein's theory was soon experimentally verified.

The particles investigated by Einstein were one micrometre (millionth of a metre) in diameter, while the water molecules that moved them were ten thousand times smaller, at around 0.1 nanometres (billionths of a metre) in diameter. That means the water molecule's heat motions are so powerful they can displace objects a trillion times

($10{,}000^3$ = 1 trillion) larger than themselves. It's no wonder that Schrödinger was concerned about what would happen on the much smaller scale of molecules *inside* a cell!

The trillion times 'punching power' that Einstein believed would violate classical thermodynamics has since also been vindicated. The *fluctuation theorem* precisely describes the effect,[16] it has been experimentally verified, and it does indeed briefly violate the 2nd Law of Thermodynamics. On timescales of about 1 second or less, particles can randomly 'collaborate' so that their combined thermal energy goes from a 'colder' state to a 'hotter' state. It is only on timescales of about 2 seconds or greater that the classical statement of the 2nd Law is valid—that thermal energy normally flows from a 'hotter' state to a 'colder' state.[17]

Let's summarize what this means for a bacterium. Brownian motion shows that the heat storm on the outside can create something comparable to gigantic ocean waves that throw ships around like corks in a perfect storm. Simultaneously, random pounding by individual water molecules continues from every direction. Biophysicist Peter Hoffman quantified this battering in his book *Life's Ratchet: How Molecular Machines Extract Order from Chaos*. He compared it to a car experiencing a wind speed of seventy thousand miles per hour![18] These horrendous forces are also at work *inside* the cell! Molecular machines function via myriad shape-changes, and these can only be achieved in the presence of abundant free water. As a result, functioning cells require more internal water than all other ingredients combined. About 80–90% of cell water in both *E. coli* and red blood cells displays single-molecule dynamics similar to that of bulk water, while only about 10% of the total is immobilized by adsorption onto internal surfaces.[19] Add to this mix the bizarre distortions caused by the heat storm *within* molecular machines themselves (figure 1) and we see that bacteria suffer molecular violence at all scales!

Figure 2. Computer simulation of Brownian motion of a solid particle 1 micrometre in diameter suspended in water, and moving across the field of a microscope at 400x magnification. It is driven by the 'heat storm' of the water molecules.[15]

Strong molecules

How do cells avoid being disrupted by this incessant molecular heat storm? Schrödinger's answer was 'strong chemical bonds'. Strong chemical bonds are universal across all living organisms. The most common strong bond occurs when one carbon atom links up with another carbon atom to form a carbon-carbon bond. This forms the 'backbone' of nearly all biological molecules. Variations are produced by adding other strong bonds with oxygen, nitrogen, phosphorus, and some trace elements. These atoms make strong bonds because they have multiple electrons that can produce complex interactions with neighbouring atoms.

In contrast, hydrogen usually forms weak bonds because it only has one electron in its outer shell and only one proton in its nucleus to positively attract it. Most organic molecules have a core structure of strong bonds, with hydrogen atoms more loosely bound around the outside. A few examples are given in figure 3.

Molecules in cells rarely act alone—they usually form *molecular machines*. But if a whole machine had to be rigidly strong, then it could not do the things that these machines need to do. It is the presence of hydrogen atoms on the outside of biomolecules that allows them to function as machine parts by repeatedly making and breaking some of the weak hydrogen bonds. However, if a machine becomes too 'floppy'

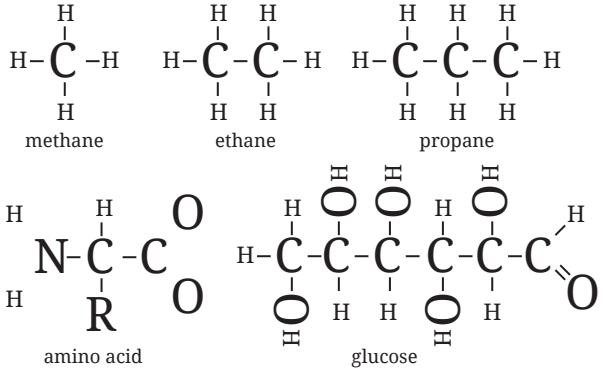


Figure 3. Organic molecules are based on strong carbon bonds. Methane (gas), ethane (gas), and propane (gas) illustrate how carbon atoms can link together, surrounded by hydrogen atoms. Amino acids (which make proteins) contain a nitrogen, two carbons, and two oxygen atoms, all surrounded by hydrogen atoms, plus a variety of side chains (R) that yield different properties. Glucose is the simplest sugar, with six carbon atoms surrounded by hydrogen and hydroxyl (OH) groups, and one oxygen atom. Lipids (not shown) are long carbon chains surrounded by hydrogen atoms, with an oxygen and hydroxyl group at one end.

the molecular storm will soon destroy it. According to Hoffman, "evolution over billions of years" provided the 'just right' solution—"highly sophisticated molecular machines" that can "tame the molecular storm and turn it into the dance of life". But this explanation is a *non sequiteur*—Darwinian evolution can only begin to occur when all the molecular machinery is already in place and sustainably functional over indefinite timescales! In Jack Szostak's words, a naturalistic origin of life requires *molecules* to "get together and work like a cell". Such an origin must begin with 'highly sophisticated' *molecules*, not with fully functional cells!

Biological candidates for first life

In the naturalistic worldview, life is an 'emergent' property of matter. Szostak's approach is typical in looking for 'the right conditions' that will allow life to emerge of its own accord from 'the right combination of molecules'. But what could such 'highly sophisticated' protolife molecules look like? They would at least have to meet Schrödinger's criteria of 'strong molecules' that 'do something' biological. Here are some possible examples.

A small protein candidate could be a *prion* (figure 4A). Prions cause contagious diseases like scrapie in sheep, mad cow disease, and kuru and Creutzfeldt-Jakob disease in humans. They are strong enough to transmit their properties beyond their cell-of-origin, through the heat storm of an animal's digestive systems, and pass across the cell membranes of different organisms and species. When the prion comes in contact with its normal protein counterpart it causes the normal form to spontaneously change shape into the 'rogue' form, and the reaction cascades through the nerve tissues of the host. Prions can 'evolve'—they always have the same amino acid sequence, but they can vary in their 3-dimensional form. When exposed to anti-prion substances, some of these variations can be resistant and are naturally selected.[20] However, they only arise and become active in the already-living nerve cells of mammals—much too far removed from life's origin.

A well-understood small piece of DNA that can 'do something' independently of a cell is a *plasmid.* It consists of a piece of double-stranded DNA, usually in a loop (figure 4B) and separate from the host's genome. It can replicate itself independently of the host's genome (but only inside the host cell) and/or splice itself into and out of the host genome. Plasmids exhibit stable molecular structure that can survive transfer from one organism to another—artificial plasmids are important tools in genetic engineering. However, like prions, they can only function inside other organisms, so life could not have originated from plasmids.

Many researchers believe that the current DNA-based life is so complex that it must have been preceded by a simpler kind of life based upon RNA. Proponents of this idea talk about an 'RNA world'—a whole world full of RNA-based life that subsequently gave rise to DNA life, then disappeared.[22] The only remnants that we see today, so they say, are RNA viruses and the multitude of RNA mechanisms that operate in modern cells. But there are no known RNA plasmids, because RNA is too unstable on its own in the natural environment. This is just one of multitudinous flaws in the RNA-world concept.[23] Every 'latest breakthrough' in this field ever more surely reinforces the fact that life requires a great deal of intelligent design and manipulation.[24]

The next step up the chain of molecular complexity brings us to *viruses,* which consist of a piece of DNA (or RNA) usually wrapped in a protein coat (figure 4C). There are vast numbers of viruses in the natural environment in, on, and around all kinds of living organisms. Very few cause disease. They make important contributions to life's diversity through their ability to transmit small amounts of DNA across species and across all of life's kingdoms. They are also remarkably stable. The protein and DNA components can be separated, stored in the laboratory, then reassembled years later and they will behave exactly as they did originally! Giant viruses—such as *Mimivirus* and *Pandoravirus*—come tantalizingly close to the requirements for minimum life.[25,26] But these viruses are thought to have originated via 'reductive evolution' from a bacteria-like common ancestor.[27] They cannot replicate outside of a host cell, and they destroy their host cell in the process, so they cannot qualify as first life.

Cells

There are no molecular assemblages known today that can "get together and work like a cell", so we are forced to 'jump the gap' and begin life with cells! They occur in three different kinds that make up the three 'domains' of life: bacteria, archaea, and eukarya. Bacteria and archaea are single-celled microbes (jointly known as *prokaryotes*), while eukarya covers all other forms of life (*eukaryotes*)—single-celled protists, multicellular animals, plants, fungi, and algae.

Bacteria and archaea are similar in size and shape, but very much smaller than eukarya. Their genome usually consists of a single loop of DNA ranging in size from 160 thousand to 12 million nucleotide pairs.[28] They both lack internal membrane-bound organelles (e.g. no nucleus) but their genomes are quite distinct and their membranes and aspects of their biochemistry differ. Despite their lack of internal membranes they do have complex internal structure. This includes close-packing of large molecules, various configurations of watery voids, and micro-compartments that can be composed of dozens, hundreds, or thousands of protein subunits.[29] The smaller compartments provide safe

containers for highly active enzymes, and the larger ones isolate metabolic cycles and pathways that are mutually incompatible.[30] Prokaryotes are not 'simple' forms of life—they are masterpieces of ingenuity.[31]

Archaea often live inside other organisms, but none are known to cause disease. Bacteria often live inside other organisms also, and are crucial in the digestive tracts of humans and animals, but quite a few are pathogenic. Many archaea live in extreme environments, such as hot springs and hyper-saline lakes, where they produce food from the energy in inorganic chemicals or sunlight. Bacteria generally feed on organic matter produced by other organisms, but some can produce food from the energy in sunlight, inorganic chemicals, and even 'raw' electrons from rocks.[32] Neither can build multicellular bodies, but they can cooperate to form multi-ellular biofilms of various kinds.

Eukaryote cells are much larger and they contain internal membrane-bound organelles. Their DNA has up to several billion nucleotide pairs, which are broken up into multiple sets of linear chromosomes, all packed inside a membrane-bound nucleus. They do occur as single-celled organisms (e.g. diatoms, yeasts) but they can also build multicellular bodies as large as dinosaurs, redwood trees, and blue whales.

Scientists are divided in their opinions over which of the three different kinds of cells is the most likely ancestor of the others. All three have unique features, and archaea have a number of features in common with eukarya, so they are not 'archaic'. A recent review concluded that "The origin of [cells] is the central and perhaps the hardest problem of evolutionary biology."[33] Since prokaryotes are much smaller and simpler in their structure than eukarya, then one of them must come first in any naturalistic origin scenario. The smallest bacteria include *mycoplasmas* (figure 4D) and the smallest archaea include *nanoarchaea* (figure 4E).

Only those cells that can live independently of others—the *autotrophs* or *primary producers* that make their own food from the energy contained in sunlight, inorganic chemicals, or electrons—can qualify as candidates for first life. All of the others would quickly decay to Schrödinger's equilibrium. One example of a primary producer is *Candidatus desulforudis audaxviator*, a bacterium that lives entirely on its own, deep underground in cracks in the rocks where there is no light or oxygen. This tiny creature is able to manufacture everything it needs from water and bare rock.[34]

Schrödinger's criterion of indefinite persistence rules out any kind of first life that might arise from a 'primordial soup' which then continues to feed upon 'left-over soup'. Survival by this means would eventually exhaust the 'soup' and the organisms would die. First life, by Schrödinger's definition, must be able to sustain itself indefinitely—and only the 'high-tech' *autotrophs* can do that!

Cell walls

A naturalistic origin of life must, on present knowledge, begin with cells. The only thing—apart from the strong molecules already mentioned—that prevents today's cells from succumbing to the chaos of the molecular storm is the cell wall.[35] This is not the place to discuss cell walls in detail so I will just give two examples of what happens when cell walls are breached.

Smear some blood on a microscope slide so that you can see the cells, then add a drop of water. The cells swell up and within a short time explode like popcorn, instantaneously disgorging their contents (figure 5). These blood cells have the same kind of cell wall (a *cytoplasmic membrane*) as is found in all other kinds of life, but they have no power to resist the heat storm. They remain safe in the blood stream only because blood is a concentrated solution of many different components. If you drink too much fluid too quickly it dilutes your blood, the cells rupture, and you can die![36]

Bacteria have a similar kind of cytoplasmic membrane around them, but it needs extra reinforcing to survive in the outside world (figure 6, left panel). We see what happens

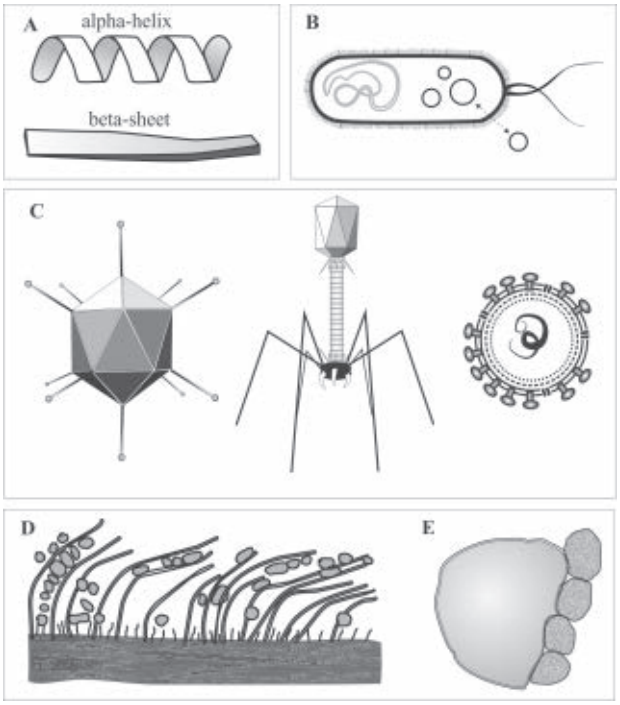


Figure 4. Possible candidates for first life. A—prions are protein molecules, a portion of which can spontaneously change shape from its normal 'alpha-helix' shape to a toxic 'beta-sheet' form. B—plasmids are small loops of DNA that can move between bacteria and splice into their DNA. C—viruses usually consist of a protein outer coat surrounding a DNA or RNA genome. D—mycoplasmas are small bacteria that live inside other organisms (in this case on the ciliated inner surface of the lung). E—*Nanoarchaeum* (the four cells on the right) can only live attached to their host, *Ignococcus*, a hot water sulphur-reducing bacterium.[21]

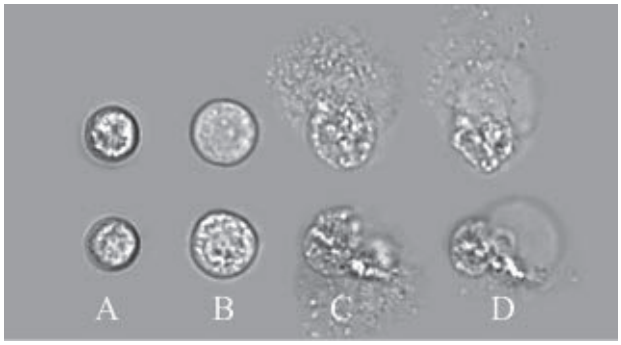


Figure 5. Selections from a video of white blood cells bursting in water.[37] The two cells left (A) are normal white blood cells as seen under a microscope. In water they swell up (B) and explode, expelling their contents (C) and leaving the empty cell wall behind (dark circles in background at D). The disgorged cell contents (bright foreground material in C and D) disperse more slowly because they are tangled up in membrane and cytoskeleton remnants.

when this protection is lost whenever certain bacterial infections are treated with an antibiotic like penicillin. Penicillin destroys the bacterium's ability to build the molecular cross-linkages in the fibrous reinforcement in the wall.[38] When the bacterium divides in the presence of penicillin the newly made dividing wall is weak and it swells up and explodes (figure 6, right panel time sequence A–D).

The cell explosions that we witness in these two examples are the result of the heat storm interacting with at least two other processes—osmotic pressure and the capillary effect. Osmotic pressure arises whenever a more concentrated solution meets a less concentrated one—as illustrated in the soy sauce experiment. The molecules inside a cell must be densely packed for the machines to function correctly (figure 5A; figure 6 left panel) and this necessarily creates a powerful osmotic pressure gradient across the cell wall. This happens regardless of the kinds of molecules involved—their size, shape, composition, and electric charge don't affect the outcome, only their concentration in relation to the medium outside.[41]

The capillary effect occurs because water molecules are polarized. The two hydrogen atoms are attached asymmetrically to the oxygen atom, and their single electrons are strongly attracted by the large oxygen atom. As a result, the oxygen end of the molecule carries a small excess negative charge, and the hydrogen end carries a small excess positive charge. When liquid water molecules come into contact with a solid surface the electric charge imbalance generally attaches it to the surface more readily than to other water molecules. The first layer of water molecules attaches most strongly to the surface, and layers further away are subject to both the surface attraction and the downward pull of gravity. This results in a 'meniscus'—the water surface turns up in a smooth curve where it touches the container walls (figure 7A).

Water's molecular polarity also creates 'surface tension'. Within a body of water every molecule is surrounded on all sides by other water molecules and the polarity charges are

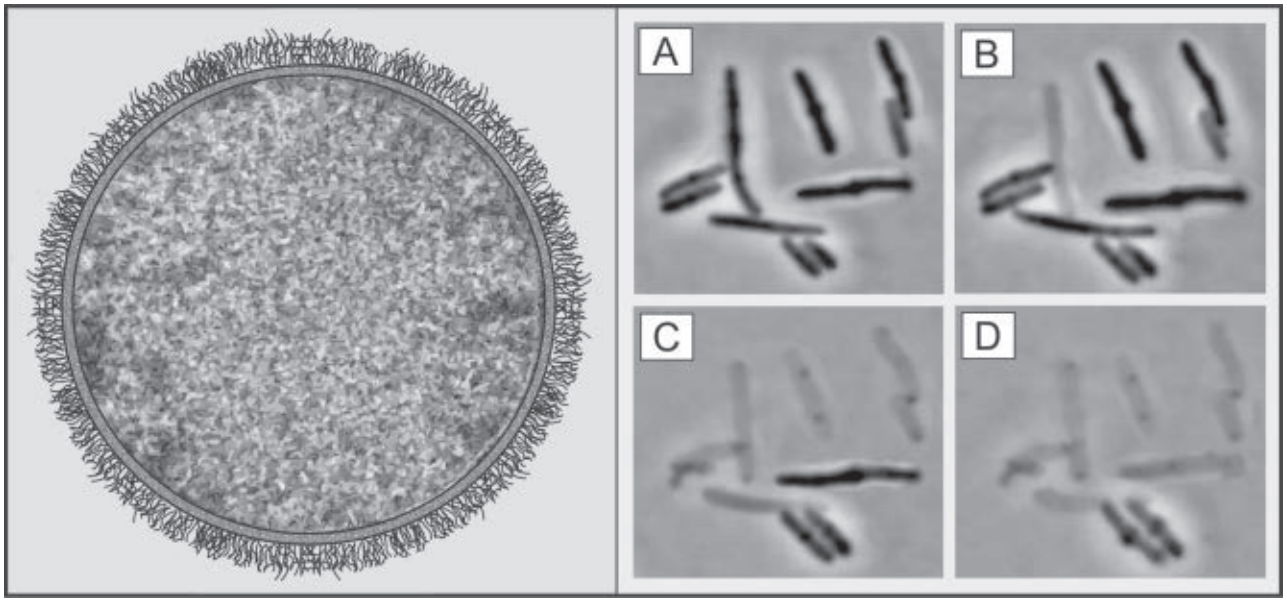


Figure 6. Schematic cross-section of a rod-shaped bacterium (left panel) showing its reinforced cell wall.[39] Right panel, composite time sequence of extracts from a video of rod-shaped bacteria treated with penicillin.[40] They grow length-wise and divide in the middle, but penicillin weakens the newly constructed dividing wall and it bulges out under osmotic pressure (A). In the blink of an eye the weak points explode, expelling the cell contents, leaving only the ruptured walls behind (grey shapes in B, C and D). The heat storm disperses the whole cell contents instantaneously because these cells are about a hundred times smaller than those in figure 5 and bacteria have no internal membranes or cytoskeleton to inhibit the dispersion.

shared equally in all directions. At the surface, however, a water molecule has no other water molecules above it. The free polarity charge at the surface causes it to bind more strongly than usual to its surface neighbours than to those within the liquid, and this produces a skin-like layer of 'surface tension'. Insects such as the water strider can walk on this surface layer without falling through.

Surface tension adds to the meniscus effect in such a way that it raises up the free water surface in narrow vessels to produce 'capillary action' (figure 7B). In extremely narrow tubes capillary action can raise the water surface up to spectacular heights (figure 7C). Plants use this effect to help them get water from the soil up to the tops of very tall trees.

Because the spaces inside a cell at the molecular scale are so tiny, capillary action has enormous power. A vertical tube 3 nanometres internal diameter (the width of a DNA molecule) could theoretically lift water more than 9 km—higher than Mt Everest—against the force of gravity.[42] This enormous capillary force is at work in the ruptured cells, sucking water onto every internal surface and into every space. And it happens at colossal speed—the tiny distances inside cells would be crossed in just picoseconds (million millionths of a second). If we add up the ever-present power of osmotic pressure, the lightning speed of water molecules, the huge sucking force of capillary action, and the ability of water molecules to collaborate and move objects a trillion times larger than themselves, then we can perhaps understand why these cell explosions occur. Once the wall is breached the cell contents are forcefully disgorged because they instantaneously swell up in the presence of the excess water and the cell walls can no longer contain them!

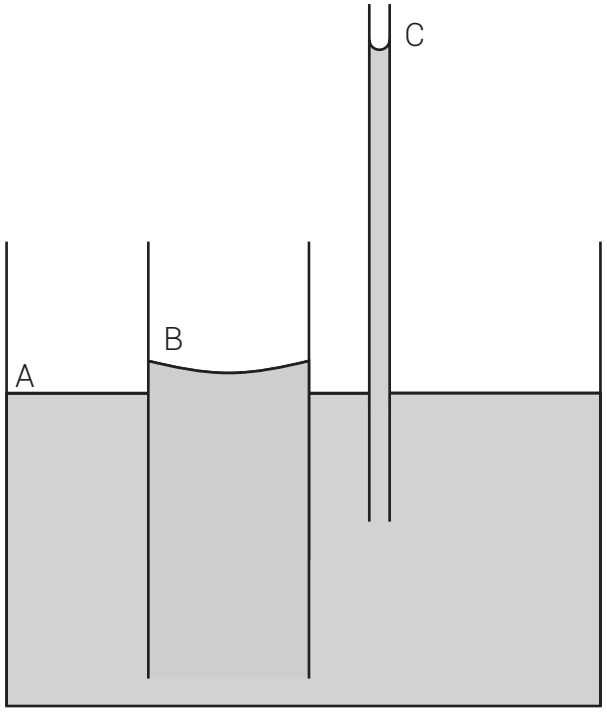


Figure 7. Capillary action. Water's molecular polarity produces a small 'meniscus' when it touches the edge of a large vessel (A). In a narrower vessel (B) surface tension adds extra lift. In a very narrow tube (C) the combined 'capillary effect' can produce much larger lift.

Answering the question

Life is that which 'does things' to sustain itself indefinitely, and this 'biological equilibrium' has to be very far away indeed from Schrödinger's physical equilibrium. Textbooks describe the methods that cells use, but to demonstrate what life is *not*, we need only look at two things: the molecular heat storm, and the cell wall.

All naturalistic theories of the origin of life must at some stage propose the development of a cell wall. There is only one way to make a cell wall—from a lipid bilayer vesicle in water—the 'porous bag' model.[43] The primordial cell wall has to be porous enough to accept continuing help from special conditions in the environment that bring the whole cell to the point of sustainable functionality, and to periodically obtain food and eject waste. There is no way to sidestep this stage—similar principles have to be followed in manufacturing artificial cells.[44]

All naturalistic scenarios require this 'porous bag' stage to hold the proto-cell contents, and this is the very thing that destroys them! The white blood cell example demonstrates that even a state-of-the-art 'porous bag'—a 'modern' cytoplasmic cell membrane—is no match for the power of ordinary water. The penicillin example demonstrates that *sophisticated reinforcing* is required for cell walls that are exposed to the natural environment. A cell wall must be strong, selectively permeable, and sensitive to outside conditions so the cell can adapt to its environment. And all this (together with Hoffman's 'highly sophisticated' cell machinery) must be assembled in less time than it takes water molecules to cross the space inside a prokaryote cell—a minuscule fraction of a second. Millions of years are of no use in helping this process along because they just make the problem at least a hundred quadrillion times harder!

Conclusion

The simplest known biological entity that can perpetuate itself indefinitely is an autotrophic prokaryote cell. Naturalism requires primordial cells to form in water because all functioning cells require more water than all other ingredients combined. Even if cells could arise naturalistically without water, they would require introduction to abundant water at some stage to explain life on Earth.[45] The physical properties of water require all the machinery of life to be encased within a strongly constructed

cell wall with all necessary properties and *no weak spots*, on a picosecond timescale. Water thus sets a threshold for cellular origin that excludes all scenarios other than Genesis-style fiat creation!

References

1. Irwin, L.N., Méndez, A., Fairén, A.G. and Schulze-Makuch, D., Assessing the Possibility of Biological Complexity on Other Worlds, with an Estimate of the Occurrence of Complex Life in the Milky Way Galaxy, *Challenges* **5**:159–174, 2014; doi:10.3390/challe5010159.
2. Making Life from Scratch: Biochemist Jack Szostak's Search for the First Cell (2012), origins.harvard.edu/pages/research-spotlight-jack-szostak, 17 June 2014.
3. de Duve, C., *Singularities*: *Landmarks on the Pathways of Life*, Cambridge University Press, 2005, inside front cover and *General Introduction*, pp. 1–5.
4. Because divine methods are beyond the reach of human experimentation.
5. Mullen, L., Defining Life, *Astrobiology Magazine*, 19 Jun 2002, www.astrobio.net/news-exclusive/defining-life/, 24 May 2014.
6. Schrödinger, E., *What is Life: The Physical Aspect of the Living Cell*, Cambridge University Press, 1944.
7. Schrödinger, E. and Penrose, R. *What is Life?* Cambridge University Press, p. 69, 2012, Kindle Edition.
8. Soy sauce contains some ethanol (from fermentation) and when mixed with water it releases energy, which makes the reaction go faster than it would if ethanol were absent.
9. In retrospect Albert Einstein's 1905 article on Brownian motion (see below) implies this state of affairs.
10. Molecular and atomic speeds were derived from the on-line calculator at: hyperphysics.phy-astr.gsu.edu/hbase/kinetic/eqpar.html#c2, 5 June 2014.
11. Carter, A.P., Clemons, W.M. Jr, Brodersen, D.E., Morgan-Warren, R.J., Hartsch, T., Wimberly, B.T. and Ramakrishnan ,V., Crystal structure of an initiation factor bound to the 30S ribosomal subunit, *Science* **291**(5503):498–501, 2001. Image in public domain at: www.ncbi.nlm.nih.gov/Structure/mmdb/mmdbsrv.cgi?uid=49513 .
12. Images used with permission from: Niels Fischer, N., Konevega, A.L., Wintermeyer, W., Rodnina, M.V. and Stark, H., Ribosome dynamics and tRNA movement by time-resolved electron cryomicroscopy, *Nature* **466**: 329–333, 2010.
13. sciweb.nybg.org/science2/pdfs/dws/Brownian.pdf, 20 Aug 2014.
14. Einstein, A., On the movement of small particles suspended in stationary liquids required by the molecular-kinetic theory of heat, *Annalen der Physik* **17**:549–560, 1905, old.stat.duke.edu/courses/Spring12/sta357/refs/Eins1905EN.pdf ; accessed 25 June 2014.
15. Drawn from simulations at: en.wikipedia.org/wiki/Brownian_motion, 20 Aug 2014.
16. en.wikipedia.org/wiki/Fluctuation_theorem, 21 June 2014.
17. Gerstner, E., Second law broken: Small-scale energy fluctuations could limit miniaturization, www.nature.com/news/1998/020722/full/news020722-2.html, 15 Aug 2014.
18. Hoffmann, P.M., *Life's Ratchet: How Molecular Machines Extract Order from Chaos*, Basic Books, Kindle Edition, ch. 6, 2012.
19. Orecchini, A. et al., Collective Dynamics of Intracellular Water in Living Cells, *Journal of Physics: Conference Series* **340**:012091, 2012.
20. Storrs, C., Prion evolution takes lessons on diversification from viruses, *Scientific American: Health & Medicine*, 1 Jan 2010; www.scientificamerican.com/blog/post.cfm?id=prion-evolution-takes-lessons-on-di-2010-01-01.
21. Drawing by author from image, used with permission; in: Huber et al., A new phylum of Archaea represented by a nanosized hyperthermophilic symbiont, *Nature* **417**:63–67, 2002.
22. Neveu, M., Kim, H.-J. and Benner, S.A., The 'Strong' RNA world hypothesis: fifty years old, *Astrobiology* **13**(4):391–403, 2013.
23. creation.com/cairns-smith-detailed-criticisms-of-the-rna-world-hypothesis, 27 June 2014.
24. Blain, J.C. and Szostak, J.W., Progress toward synthetic cells, *Annual Review of Biochemistry* **83**:11.1–11.26, 2014, doi: 10.1146/annurev-biochem-080411-124036.
25. Legendre, M. et al., mRNA deep sequencing reveals 75 new genes and a complex transcriptional landscape in *Mimivirus, Genome Research* advance online version, 1 April 2010, doi:10.1101/gr.102582.109.
26. Yong, E., Giant viruses open Pandora's box: Genome of largest viruses yet discovered hints at 'fourth domain' of life, *Nature News*, 18 July 2013.
27. Raoult, D., The Journey from *Rickettsia* to *Mimivirus*, *ASM News* **71**(6): 278–284, 2005.
28. en.wikipedia.org/wiki/Bacteria#Genetics, 6 November 2014.
29. Yeates, T.O. et al., Protein-based organelles in bacteria: carboxysomes and related microcompartments, *Nature Reviews Microbiology* **6**:681–691, 2008.
30. Sutter, M. et al., Structural basis of enzyme encapsulation into a bacterial nanocompartment, *Nature Structural & Molecular Biology* **15**:939–947, 2008.
31. Spitzer, J., From water and ions to crowded biomacromolecules: in vivo structuring of a prokaryotic cell, *Microbiology and Molecular Biology Reviews* **75**(3):491–506, 2011.
32. Brahic, C., Meet the electric life forms that live on pure energy, *New Scientist* **222**(2978), 16 July 2014; www.newscientist.com/article/dn25894-meet-the-electric-life-forms-that-live-on-pure-energy.html?full=true#.U-26AfmSya8.
33. Koonin, E.V., The origins of cellular life, *Antonie van Leeuwenhoek* 04/2014, DOI:10.1007/s10482-014-0169-5.
34. Chivian, D. et al., Environmental genomics reveals a single-species ecosystem deep within earth, *Science* **322**(5899):275–278, 2008.
35. I use the term 'cell wall' in the most general sense for ease of understanding. All cells are surrounded by a lipid-bilayer *cytoplasmic membrane*, while bacteria, fungi, and plants have an additional 'cell wall' to provide extra strength.
36. en.wikipedia.org/wiki/Water_intoxication, 21 Aug 2014.
37. Video still images extracted from *CellBiophysics*, reuse allowed under Creative Commons License, www.youtube.com/watch?v=OYoaLzobQmk, 4 July 2014.
38. en.wikipedia.org/wiki/Penicillin, 24 June 2014.
39. Drawn from: en.wikipedia.org/wiki/Bacillus_subtilis#mediaviewer/File:Bacillus_subtilis.jpg, 6 June 2014.
40. Video at www.cellsalive.com/pen.htm used with permission, 13 Nov 2014.
41. Osmotic pressure is a colligative property of solutions: chemwiki.ucdavis.edu/Physical_Chemistry/Physical_Properties_of_Matter/Solutions_and_Mixtures/Colligative_Properties, 19 Aug 2014.
42. en.wikipedia.org/wiki/Capillary_action, 20 June 2014.
43. Woese, C.R., On the evolution of cells, *Proc. Natl. Acad. Sci. USA* **99**(13):8742–8747, 2002.
44. en.wikipedia.org/wiki/Artificial_cell, 4 July 2014.
45. Barras, C., Home and dry, *New Scientist* **222**(2965):36–39, 2014.

Alex Williams *B.Sc., M.Sc.(Hons), M.AI.Biol., Dip.C.S., Th.L. has been a professional botanist, analytical chemist, environmental consultant, statistician, missionary, science writer, and illustrator, and has published numerous peer-reviewed articles on a wide range of subjects. He was an Australian representative and then consultant to the International Atomic Energy Agency, chairman of an international group of scientists, and delivered the invited review in his field at an international symposium. He is currently research associate at the Western Australian Herbarium in grass taxonomy, and has contributed many items to Creation and* Journal of Creation *and co-authored* Dismantling the Big Bang.

Magnetized moon rocks, impacts, and the Precambrian—a response to Humphreys

Wayne Spencer

This responds to the recent paper by Humphreys[1] proposing that accelerated radioactive decay, Precambrian rock formation, and impacts were all occurring in the pre-Flood period. However, the scale of these processes makes them unrealistic for the pre-Flood period. Also, other scenarios are possible and should be considered by creationists. Much Precambrian rock formation could have been in the Creation Week, as could some impacts. Humphreys suggests the magnetic decay on the moon is related to the radioisotope age but this has not been clearly established.

In *J. Creation* 28(3)[1] Dr D. Russell Humphreys proposes a scenario for integrating data relating to remnant magnetism in moon rocks with accelerated radioactive decay and Precambrian rocks on Earth. Though I have great respect for Humphreys and his many contributions to creationist research, I find his scenario premature, at least, and perhaps very unrealistic. I would like to suggest that other scenarios be considered. I have recently changed my point of view regarding impacts and this may have relevance to the issues Humphreys is addressing. There is also other recent work that I feel must be mentioned since it could have important implications. I want to commend Humphreys for addressing the issue of reconciling the magnetic data, the radioactive decay data, and the impact data. There is a need for research and discussion on these questions among creationist researchers.

Impacts on Earth and the solar system

I will begin with how my own view of Earth and solar system impact cratering has changed. Beginning with papers[2,3] presented at the International Conference on Creationism (ICC, 1998), I argued for impacts from space taking place on Earth during Noah's Flood, although at that time I felt it was not clear what the number of impacts would have been for Earth. But recent papers by Oard[4,5] and Spencer[6] examine crater data for the moon as a basis for estimating the number of Earth impacts. Earth is a much bigger and more massive target than the moon. Therefore it stands to reason that there should be more impacts on Earth than the moon. I proceeded on the assumption that the earth should not be treated separately or as special regarding impacting objects in the solar system. Oard estimated Earth received on the order of at least 36,000 impacts. This was based on statistics with the smallest craters being of approximately 30 km diameter, the largest being about 300 km diameter, and Oard estimated for larger sizes.[4] I later updated that estimate to 58,000 based on data from the Lunar Reconnaissance Orbiter (figure 1).[5] At the ICC in 2013 there was a very significant panel discussion on impacts. The possibility of impacts on the fourth day of Creation Week was brought up in that panel discussion. Dr Danny Faulkner then put forward the Day 4 impact hypothesis in a paper published online in *Answers Research J.* (ARJ) on 22 January 2014.[7] I then published a response to Faulkner in the ARJ on 10 September 2014.[8] I am now convinced that the Day 4 cratering hypothesis is the most reasonable view of impact cratering.

The Day 4 cratering hypothesis proposes that many thousands of impacts could have taken place on Day 4 as a part of God's creation of the moon and other solar system bodies. But these impacts during Creation Week would not have taken place on Earth.[7,8] This would then imply that the impacts that took place during Noah's Flood were part of a separate event that involved a much smaller number of impacts. Thus by this view there were two episodes of impact bombardment, one outside Earth on the fourth day of Creation Week and another on Earth at the time of the Noah's Flood. Faulkner also proposes that solar system moons and planets were formed on the fourth day of creation from small particles or objects created on Day 1 of Creation Week. Adopting this view represents a change in my perspective.

First it puts impacts before Noah's Flood, which was an idea I resisted. I took the view that the Creation Week was an inappropriate time for impacts. But now I would view impacts as just another process God used to form the surfaces of objects in the solar system. But this would not apply to Earth because tens of thousands of large impacts would threaten life on Earth too much and have many severe effects. I concluded that the number of large impacts makes it impossible to have all the impacts during Noah's Flood. The same problem remains if impacts are merely spread out over the pre-Flood period, or if impacts took place beginning at the Fall. It seems an inescapable conclusion to me now that whenever the impacts took place, God supernaturally

protected the earth. Earth must be treated as a special case among the planets regarding impacts. Earth was certainly treated as special in the Creation Week since it was made first. I do not believe Scripture rules out the possibility of impacts occurring outside Earth in the solar system on the fourth day of creation.[8] On the other hand, it simply will not do for life on Earth to be threatened from impacts in the Creation Week. The fourth day impacts hypothesis answers these concerns.

Regarding Humphreys' comments on impacts, I am puzzled as to how many impacts Humphreys believes took place on Earth. He refers to a number of 5,000 craters for the moon, 20 km and greater in size. But what about Earth? Humphreys doesn't make clear his thinking on this. Even taking 5,000 as the number of impacts on Earth, the effects during the pre-Flood period would have been very severe because these are not small impacts. Besides, 5,000 is an unreasonably low number for Earth. Only about 184 identifiable sites are known on Earth today.[6] The crater statistics based on lunar data do not include the largest craters on the moon such as the large mare basins on the near side. Could these also happen on Earth? Could an impact the size of the Aitken Crater (figure 2) happen on Earth (2,500 km diameter)? It becomes implausible because of the number of large craters. It is after years of thinking about the scale of the impacts problem that I have changed my perspective.

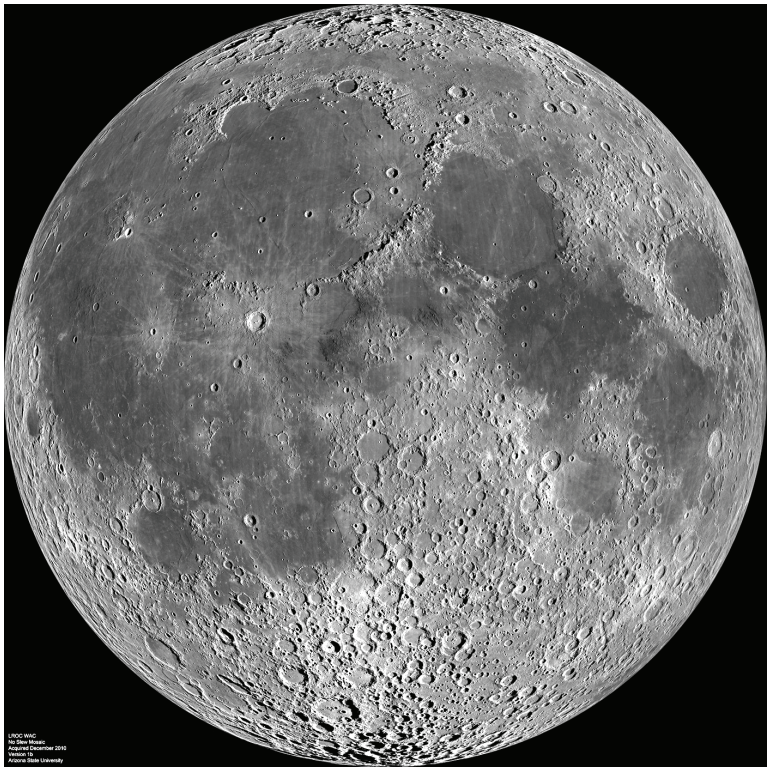


Figure 1. Nearside of the moon. Mosaic from the Lunar Reconnaissance Orbiter, from 2010.

Magnetic lunar samples

The relevant question in Humphreys' paper is: how are impacts on the moon related to magnetized lunar samples and radioactive decay? Many *Apollo* samples are related to the Imbrium basin or one of the smaller craters around its periphery. Thus *Apollo* samples in many cases date to about the time of the formation of the Imbrium impact crater, or the lava flows that followed it. (This does not mean the impact really drove the volcanism but merely that the fractured crust allowed lava to reach the surface easily.) These lava flows often originated within the large craters. The magnetization in the lunar samples was 'frozen' in at the Curie temperature as the rock cooled. Therefore the magnetization of the lunar samples is clearly related to the rock formation on the moon. But it is not necessarily the case that the magnetization of the samples is correlated to the radioactive age of the samples. I do not believe Humphreys has made a strong case for a correlation of the magnetic age with the radiometric age. This correlation should be more well established.

Dr Andrew Snelling (who was also involved in the RATE research project) has recently published papers online with the *Answers Research J.* related to radioactive dating of meteorites.[9,10] Though somewhat tentative, Snelling's analysis suggests that accelerated radioactive decay may not have taken place outside Earth. Snelling points out that there is no consistent pattern related to the atomic weight of the isotopes as was observed in the RATE study among the radioactive isochron dates of meteorites. Thus Snelling suggests that daughter isotopes present in the meteorites may be primordial; that is, they were created and not from radioactive decay. Note that this was regarding meteorites, not lunar samples, collected by *Apollo* astronauts. It remains to be seen what the so-called 'lunar meteorites' may indicate about accelerated radioactive decay. There are known meteorites found on Earth that have compositions matching known areas on the moon; these are the lunar meteorites.[11] Impact physics certainly makes it plausible that small ejecta could leave the moon's gravity and then later fall onto Earth. If Snelling's conclusion is born out this would be a significant problem for Humphreys' scenario. Without accelerated radioactive decay the moon's core may not melt if it were created initially solid. Furthermore, the radioactive ages for the lunar samples would not validly correlate with magnetic data. It would mean there may not be a simple way to take radioactive dates as a valid 'relative'

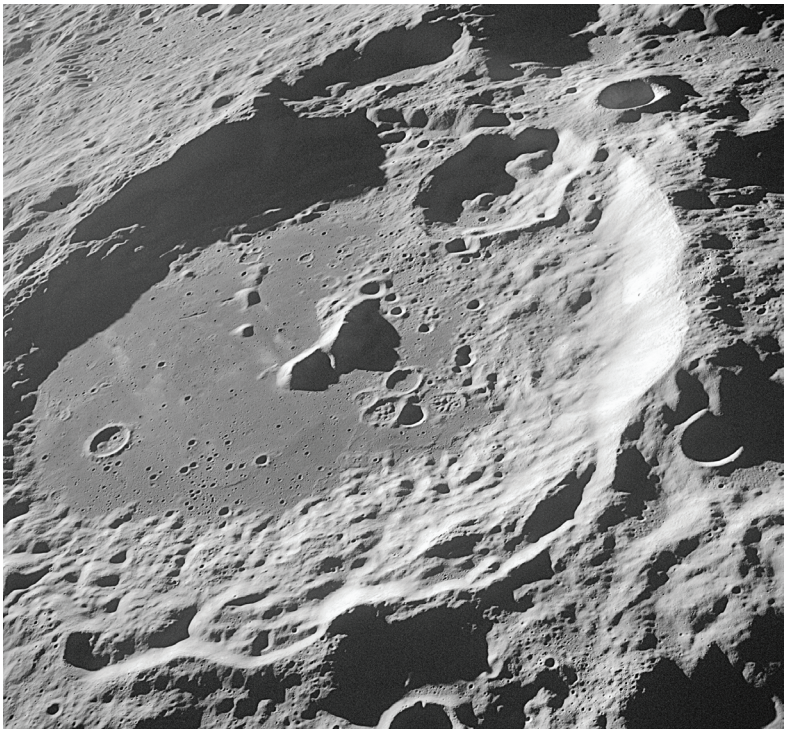


Figure 2. Oblique view ofthe Aitken crater from Apollo 17.

time marker between Earth and solar system bodies outside Earth. It is not clear to me that radioactive age dates for lunar samples correlate with radioactive dates from Earth rocks, even if they give the same age result. I think we have to say that as yet this correlation has not been really established, but merely assumed by some creation researchers.

To be clear, I accept the conclusions of the RATE research for the evidence on Earth documented in the RATE study. I also accept Humphreys' magnetic model as valid. Humphreys' geomagnetism model seems to work well for a wide range of objects in the solar system. But I would suggest creationist researchers be cautious about assuming that moons or planets outside Earth can be treated the same as Earth.

The lunar core

Humphreys has a good discussion of the moon's core, its conductivity and how the range in the conductivity could affect the decay time for the moon's magnetic field. I do not dispute any of Humphreys' information in this section but I would like to emphasize there are a number of possible scenarios for how the moon's core could have started at creation and then come to how it is now. Some might suggest other possible mechanisms for causes of remanent magnetism on the moon. But secular lunar scientists have explored other mechanisms for years because it is well known that there are difficulties explaining the magnetic lunar samples and lunar magnetic anomalies. I do not believe other mechanisms can adequately deal with the evidence. The moon must have had its own magnetic field at one time. The magnetic field of the moon could have decayed away before the Flood or possibly might have lasted till after the Flood. When I use a lunar core radius of 360 km in Humphreys' equation (1), only about 10% larger than Humphreys' value of 330 km, I arrive at a decay constant of 784 years. (Recall that the decay constant is equal to the natural logarithm of 2 divided by the half-life.) This would mean the moon's field would still exist but be very weak by the time of the Flood. One recent study

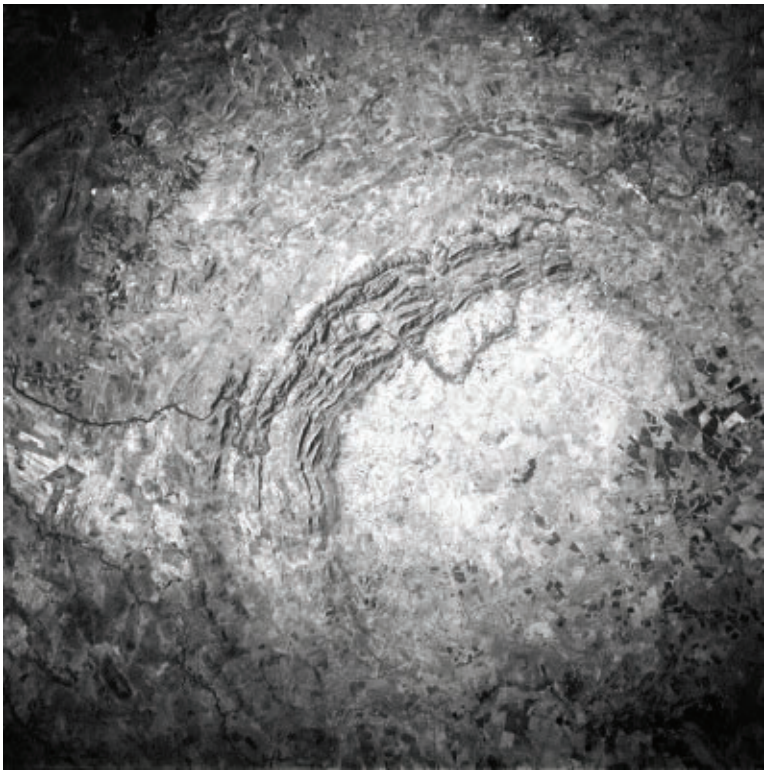


Figure 3. The Vredefort dome structure is in South Africa and has a uniformitarian age of approximately 2 billion years.

measuring the size of the lunar core arrived at an upper limit of 400 km.[12] Thus, there could be multiple possible scenarios for the decay of the moon's field. Did the lunar core start with a molten outer core at creation and partially cool or did it start solid and then melt? Humphreys is suggesting the latter and treats the moon's core as very similar to Earth's. This is fine as an approximation, but other scenarios should be explored.

Precambrian rock

Humphreys has a discussion of Earth's Precambrian rock in relation to his scenario. He suggests Precambrian rock was forming after Creation Week during the pre-Flood years. This is potentially the most unrealistic aspect of Humphreys' scenario. The problem is one of scale. I would not want to live in the pre-Flood world Humphreys describes. The pre-Flood world, it seems to me, should be a quieter place. In Humphreys' paper, the amount of geologic activity proposed in the pre-Flood world would seem very hazardous for life, with geologic events as well as large impacts all taking place. Note that Earth impact craters found in Precambrian rock do not necessarily mean that the impact occurred when the rock formed. The impact could have occurred sometime after the rock formed if that rock were on or near the surface. Thus the Precambrian rocks where the Vredefort or Sudbury impacts (figure 3) are found could have formed in the Creation Week, such as possibly on the third day, but the impacts may have taken place at the time of the Flood. I am not a geologist but I find Dickens and Snelling's harmonization of Precambrian geology and the Bible[13] plausible in most respects, though there are a number of details that need more research. Their proposal would put most Precambrian rock as forming in the Creation Week, whereas I suspect some Precambrian rock did form in the Flood. But the volume of Precambrian rock would suggest that it's unrealistic for all of it to have formed in the pre-Flood period or in the Flood itself. It is a problem of scale, somewhat like the impacts problem.

Conclusions

I would argue that much Precambrian rock formation on Earth and impacts on the moon likely happened in the Creation Week, as described above. There is, however, a need for more research on the origin of Precambrian rock. Decay of the moon's magnetic field could have continued through much of the pre-Flood period with few ill effects on life. But this is not the case regarding accelerated radioactive decay or Precambrian rock formation on a large scale. There is a need for creation researchers to deal with meteorite radioactive ages, especially those of the lunar meteorites. If some radioactive daughter isotopes associated with uranium or potassium decay were created this could have many implications for integrating the magnetic data on the moon with radioactive decay data and with the Precambrian rock record on Earth. I would now hold to the fourth day impacts scenario much as Faulkner has suggested. The magnetic data from lunar samples and meteorites does need to be related to radioactive decay data but as yet it is unclear how to do so in my opinion. Thus I would suggest more research before accepting Humphreys' hypothesis. More debate on these issues is welcome and appropriate.

References

1. Humphreys, D. R., Magnetized moon rocks shed light on Precambrian mystery, *J. Creation* **28**(3):51–60, 2014.
2. Spencer, W.R., Catastrophic impact bombardment surrounding the Genesis Flood; in: *Proceedings of the Fourth International Conference on Creationism*, Walsh, R.E. (Ed.), Creation Science Fellowship, Pittsburgh, PA, pp. 553–566, 1998.
3. Spencer, W.R., Geophysical Effects of Impacts During the Genesis Flood; in: *Proceedings of the Fourth International Conference on Creationism*, Walsh, R.E. (Ed.), Creation Science Fellowship, Pittsburgh, PA, pp. 567–579, 1998.
4. Oard, M.J., How many impact craters should there be on Earth? *J. Creation* **23**(3):61–69, 2009.
5. Oard, M.J., An impact Flood submodel—Dealing with issues, *J. Creation* **26**(2): 73–81, 2012.
6. Spencer, W.R., Impacts and Noah's Flood—How many and other issues, *J. Creation* **27**(1):85–89, 2013.
7. Faulkner, D., Interpreting craters in terms of the Day Four Cratering Hypothesis, *Answers Research J.* **7**:11–25, 2014, answersingenesis.org/contents/379/arj/v7/craters_day_four.pdf, accessed 12/18/2014.
8. Spencer, W., Evaluating the Day Four Cratering Hypothesis, *Answers Research J.* **7**:323–329, 2014, answersingenesis.org/arj/v7/day_four_cratering.pdf, accessed 18 December 2014.
9. Snelling, A.A., Radioactive dating of meteorites i: the allende cv3 carbonaceous chondrite, *Answers Research J.* **7**:103–145, 2014, answersingenesis.org/contents/379/arj/v7/radiosisotope_dating_Allende.pdf, accessed 12/18/2014.
10. Snelling, A.A., Radioactive dating of meteorites ii: the ordinary and enstatite chondrites, *Answers Research J.* **7**:239–296, 2014, answersingenesis.org/arj/v7/radioisotope_dating_meteorites.pdf, accessed 18 December 2014.
11. Korotev, R.L., How Do We Know That It's a Rock From the Moon? Dept of Earth and Planetary Sciences, Washington University of St. Louis, meteorites.wustl.edu/lunar/howdoweknow.htm, accessed 12/18/2014.
12. Shimizu, Hisayoshi *et al.*, Constraint on the lunar core size from electromagnetic sounding based on magnetic field observations by an orbiting satellite, *Icarus* **222**:32–43, 2013.
13. Dickens, H. and Snelling, A.A., Precambrian geology and the Bible: a harmony, *J. Creation* **22**(1):65–72, 2008.

Wayne Spencer *B.S., M.S. Wayne Spencer obtained his master's degree in physics from Wichita State University in Kansas. Active in creationist circles, he has taught science and maths, and is a software manager in Dallas, Texas.*

Becoming one flesh

Kathy Wallace

Women are at risk from sexual involvement with multiple partners. This can impact their health and increase the risk of miscarriage in pregnancy, low birth weight and dangerous diseases that have the potential to kill. Additionally, the intriguing, relatively recent discovery of DNA in the bodies of women, originating from the fathers of their children, has brought attention to an unsuspected biological closeness between a woman and her children, and between a mother and her spouse. This DNA, clearly distinct from the mother's, has been shown to persist in her body for decades after a pregnancy. Its presence not only may have health effects, but also exemplifies the deep biological union between a man and a woman, facilitated by the children they have together.

"For this reason a man shall leave his father and his mother, and be joined to his wife; and they shall become one flesh" (Genesis 2:24).[1]

There are rules about human relationships and reproduction entrenched in the Ten Commandments and elsewhere in the Bible. Scripturally, marriage is meant to be between one man and one woman, entered into for life.

In Jewish tradition the purpose of marriage is to procreate. Some women in the Bible were unable to bear children ever, like David's wife Michal; or until advanced in years, like Sarah, Hannah, and Elizabeth (and even then only by divine intervention). Or sometimes circumstance rendered them unable to bear children until years after marriage, like Tamar or Rachel. All would have struggled personally and socially for years, since the essence of Jewish womanhood was bound up with motherhood and the act of bearing children. Children were treasured, as demonstrated by the blessing given to Rebekah when she accepted the proposal of marriage brought to her—Genesis 24:60: "As they were leaving, they all blessed Rebekah by saying, 'Our sister, may you become the mother of tens of millions! May your descendants take over the city gates of those who hate them.'"

The church is the bride of Christ (2 Cor. 11:2), and He, as the perfect bridegroom, will return to acquire her. This symbol of marriage is exemplified by the notion of exclusivity.

Microchimerism: male DNA in women's bodies

There has recently been an explosion in the medical literature regarding microchimerism. In Greek mythology, 'chimera' were fire-breathing monsters with lions' heads, goats' bodies, and serpents' tails—i.e. made up from biologically different organisms (figure 1). 'Microchimerism' was first coined by a French mouse researcher to denote the coexistence, in the same organism, of two cellular populations derived from two different individuals.[2] In humans, cells derived from another person may persist in the body from diverse events, such as pregnancy, organ or tissue transplantation, or blood transfusion.[3]

Long known and widely reported is 'fetal microchimerism'—presumed fetal cells, including DNA, detected in women, which clearly have a different genetic make-up to that of the woman. In 1893 Georg Smorl described the presence of fetal cells in the maternal circulation, and reported on the importance of this in regard to pre-eclampsia.[4] His findings have been confirmed using advanced molecular techniques.[5,6] The presence of such genetically different cells was perhaps not quite as surprising as the fact that they persist in the maternal circulation and body for years. This is in contradiction to the traditionally held obstetric view, firstly that the placenta behaved like a barrier between maternal and fetal circulation, and secondly a more recent, widely held view, that fetal cells that gained entry to the maternal circulation would be destroyed by the maternal immune system, during or shortly after delivery. As claimed by Williams in 1907, "The foetal blood in the vessels of the chorionic villi at no time gains access to the maternal blood in the intervillous spaces".[7] In the 1960s and '70s, fetal leukocytes, or white blood cells, were described in maternal circulation.[8–10] Additionally, such cells were detected as early as at 15 weeks of gestation.[11,12]

So, how can fetal cells specifically be identified in maternal serum? Herzenberg *et al*. detected cells in maternal blood that carried the Y chromosome, from pregnancies with a male child.[11] The fetus would have paternal 'antigens' or cell surface markers obtained from his father. Using an immunological technique, they were able to confirm, after the birth of the baby, that the infant's cells were indeed the same ones found in the mother's blood while she was still pregnant. The researchers knew that these women were carrying a male fetus as the women had undergone amniocentesis[11,13] at 15 weeks gestation to diagnose a possible fetal abnormality. Upon analysis, they were found to be carrying male babies. Fascinatingly, however, the study's authors accept that the male cells detected in the maternal circulation may have been acquired by means other than the pregnancy in question, in an earlier pregnancy or during a procedure such as a termination (abortion).[9]

Bringing forth the fruit of one's womb …

It is not by accident that behaviours stated in Scripture to be sinful, such as adultery and fornication, are also unhealthy. Many women know that their regular pap smears are designed to detect early changes in the cervical cells that may lead to cancer. But many are unaware that this disease is caused by a sexually transmitted virus called the human papilloma virus (HPV).[14–16] Condoms do not protect against infection by this family of viruses.[17]

Notably, where sexual partners commence a relationship while virgins, and remain together for life in an exclusive relationship (figure 2), the woman's risk of acquiring HPV and, subsequently, cervical cancer, is exceedingly low.[18] The Oxford Textbook of Pathology states, in regard to this, that women are at higher risk of cervical cancer by:

- having multiple sexual partners
- having a partner who has had multiple sexual partners
- having sex at a young age.

Changing sexual partners and risks to subsequent pregnancy

A further risk to women from a change of sexual partner is illustrated by pregnancy-induced hypertension, which when severe was previously known as 'toxaemia', or 'pre-eclamptic toxemia', aka 'pre-eclampsia'. This can progress to full-blown eclampsia, an acute and life-threatening complication causing convulsions that can proceed to coma and even death of the pregnant woman and her unborn baby. First-time pregnancies, as well as the first pregnancy after a woman changes sexual partners, carry the greatest risk.[19,20] This indicates that passage of paternal antigen across the placenta may cause maternal disease.[21] This results from the woman's immune system's not being appropriately exposed to sperm from her partner for long enough for her immune system to recognise his 'foreign' tissues as acceptable.[22–26] Appropriately long exposure ensures that her immune system will behave tolerantly towards the embryo that results from their union, and that is half made up of his genetic material and half of hers.[27–30] It is understood that having protected sex by use of condoms, called the barrier method, or indeed using the 'withdrawal method' of protection against pregnancy, can lead to eclampsia risk in the first pregnancy.[31,32] A small trial involving less than 4,000 women also revealed an increased risk of pre-eclampsia in women using the oral contraceptive pill, but only when used for longer than 8 years.[33] In a small 2012 study, partner change was considered a significant factor in pre-eclampsia and low birth weight.[34] A larger study, in 2012, determined that paternal factors were critical in risk and occurrence of pre-eclampsia as well as low birth weight, but also declared the following weakness in their study:

> "Although we had the opportunity to account for several important possible confounders that were not controlled for in earlier studies, we were not able to control for previous semen exposure, abortions and miscarriages or paternal characteristics."[35,36]

Low birth weight and preterm deliveries were also associated with prior termination of pregnancies, or abortions,[37] and longer-term consequences for health.[38]

There is presently good evidence to suggest that the immune tolerance generated in the woman by unprotected sex with her husband results in successful and complication-free pregnancy outcomes. This outcome has been linked not to coitus alone but to sperm exposure. The presence of sperm in the woman's body provides priming events for exposure to the female T cell lymphocytes resulting in maternal immune tolerance to the paternal antigens.[39,40] These T cell lymphocytes, thus reprogrammed, recognise the paternal antigens in the conceptus and facilitate implantation rather than attack the 'foreign' cells. There is burgeoning medical literature demonstrating that a lack of immune tolerance has been linked with severe complications, including risk of miscarriage, preterm labour,[41] pre-eclampsia,[42] preterm rupture of membranes (that is, the mother's waters breaking prematurely), placenta abruption (the placenta coming away from the uterine wall prematurely), intrauterine growth restriction (a baby who will not achieve normal weight and size), and HELLP syndrome,[43] (haemolysis, elevated liver enzymes, and low platelets—a devastating disease described as a worse form of eclampsia).[44,45] The significance of maternal immune intolerance is further illustrated by the higher risk of pre-eclampsia and miscarriage in pregnancies from in-vitro fertilization, or IVF.[46–48]

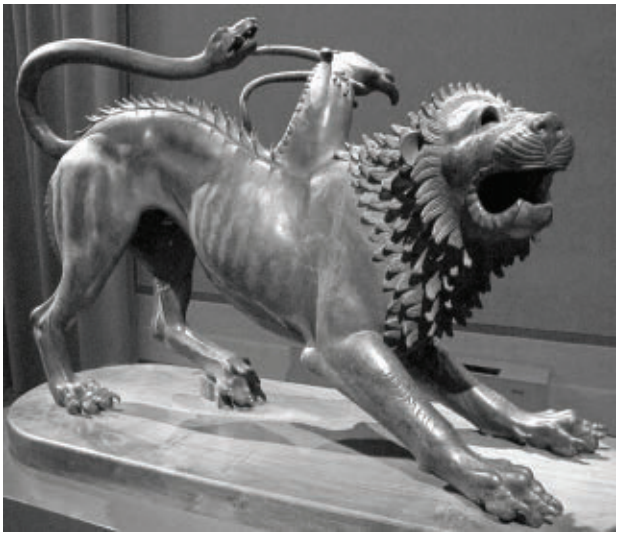


Figure 1. In Greek mythology, 'chimeras' were fire-breathing monsters with lions' heads, goats' bodies, and serpents' tails—i.e. an amalgam of biologically different organisms.

Prenatal screening and risk of sex selection

The applications of such prenatal detection of fetal cells led to the development of screening tests,[49,50] the refined versions of which are used today to assess the risk of chromosomal abnormalities in a pregnancy.[51,52] The underlying rationale of this 'first and second trimester screening' is to give a couple, at worst, 'justification' to terminate a pregnancy (i.e. kill their baby) if it is carrying abnormal chromosomes, or, at best, advance warning to prepare for a possible abnormal outcome in their progeny. A disturbing reality of the newer breed of prenatal-screening blood tests, presently being offered by numerous pathology laboratories in Australia, is the potential for sex selection; that is, termination of a pregnancy based on the sex of the baby. It is also reported that finger prick blood test kits are available via mail order for sex determination of an unborn child. Costa *et al.* were able to detect fetal DNA in the maternal circulation at 42 days and had no false negatives in detecting pregnancies with male babies,[53] which is a reflection of the accuracy of such tests.

Two-way traffic

This area of molecular biology, while an exciting frontier in medicine, leaves numerous unanswered questions as well, such as the significance of a woman's mother's microchimerism detected in women with healthy pregnancies versus this form of maternal grandmother-microchimerism being relatively absent in women with pre-eclampsia.[54,55] Also, while fetal cells migrate into the maternal circulation, maternal cells similarly enter the fetus.[56] It has been noted that maternal cells in the fetal circulation also perform immune-modulating functions and cause suppression, or tolerance, in the fetus towards maternal antigens.[57,58] It is critical that immune suppression towards maternal antigens occurs without over-suppression of the fetal immune system—a balance here is important.[59] The significance of this materno-fetal microchimerism seems related to and enhanced by breastfeeding and also may cause tolerance towards infective agents, such as HIV acquired via vertical transmission that is, from mother to child. Recent research, including that in animal models, has revealed that maternal cells in the fetal circulation occur in all pregnancies, and can be detected as early as 4 weeks and 5 days. Other reports have indicated that maternal cells gain access to the fetal circulation as early as 9–10 days post-conception.[60] Thus, as described above, materno-fetal microchimerism provides necessary immune regulatory functions, akin to a military force undertaking measures to minimise casualties by friendly fire. It seems that maternal cells gain entry via the placenta in all pregnancies and result in tolerogenic fetal immune responses to non-inherited maternal antigens. A mother gains the advantage from feto-maternal microchimerism by the potential protection afforded by a supply of fetal cells that are pluripotent (that is, behaving like stem cells), and that may aid cellular repair.[61,62]

How do fetal cells gain access to maternal circulation?

The exact mechanism by which fetal cells gain access to the maternal circulation requires further clarification. However, increased trafficking of fetal cells into the maternal circulation can occur in a variety of events such as external cephalic version,[63] where a baby positioned the wrong way in the uterus is turned manually by an obstetrician; as well

Figure 2. Sexual intimacy and bearing children result in becoming 'one flesh' through shared DNA.

as miscarriage and abortion.[64] In an abortion, destruction of the placenta may be the means by which fetal cells gain entry into the maternal circulation.[65] This has been disputed, though, in an animal model where complete hysterectomies rather than abortions were performed on pregnant mice, and fetal DNA was, nonetheless, detected in maternal tissues, leading the authors to speculate that fetal microchimerism occurred prior to placental implantation.[66] Another animal model has demonstrated that should the exposure of fetal antigens to the maternal circulation occur via disruption or intervention in the fetus, as in the case of pre-natal fetal surgery, there is an increased risk of fetal demise from activation of maternal T lymphocytes and an immunogenic reaction to the fetus.[67]

Male microchimerism in women who were never pregnant with male babies

Surprisingly, women who have never been pregnant with sons have also tested positively for male fetal microchimerism. A 2005 study set out, as a secondary objective, to gauge whether male microchimerism detected in women could possibly have arisen from sources other than pregnancy with a male child. It is suspected that persistent male DNA may be present in some women from a twin pregnancy, an older brother via maternal transfer, unrecognized miscarried pregnancies and sexual intercourse.[68] This study also reported a higher rate of fetal microchimerism in women that had had elective abortions. Sexual intercourse as a means of male DNA transfer has been considered as possible in other studies as well, where women who have never been pregnant are found to be positive for male microchimerism.[69] The authors suggested that the term 'fetal' DNA be replaced by 'exogenous' DNA, and that the specific origin of all male DNA in women be further investigated. It would be interesting to record whether or not 'male DNA' is limited to detection of a Y chromosome, or whether there is DNA specific to a particular male sexual partner.

Disease states associated with microchimerism

Microchimerism has been detected in autoimmune diseases, cancers, and endocrine disorders.[70] Persistent fetal microchimeric cell lines have been known to endure in maternal bone marrow and are postulated to seed into maternal tissues, being detected as long as 27 years after the birth of the baby.[71] Thyroid diseases are linked to microchimerism, and fetal microchimeric cells are absent from healthy thyroids in some reports.[72–74] Likewise, microchimerism has been investigated in different autoimmune disorders, such as systemic sclerosis, systemic lupus erythematosus, autoimmune thyroid diseases, as mentioned above, primary biliary cirrhosis and juvenile inflammatory myopathies.[75] However, microchimerism is also detected in the thyroids, lungs, skin, lymph nodes, kidneys, livers and hearts of healthy women in other reports.[76–78]

Male microchimerism has been detected in multiple brain regions in women with and without Alzheimer's disease.[79] Since Alzheimer's disease rates are higher in women that have had children than those that have not, it was expected that male microchimerism may be higher in women with Alzheimer's disease. Unexpectedly, precisely the opposite results were found; male microchimerism was higher in women without Alzheimer's disease. However, as the authors explain, their sample size was modest, and further work in this area is needed. Of interest, the oldest woman in whose brain male microchimerism was detected was 94 at the time of her death (figure 3).

Male microchimerism was also detected in the livers, diseased or normal, of females, whether they had had male offspring or not—and also in the livers of deceased female fetuses.[80] Forty-six liver samples from 29 women, 6 female children, and 11 female fetuses were screened for the Y chromosome via polymerase chain reaction (PCR) assay and fluorescent in situ hybridization (FISH). The Y chromosome was detected in 5 of 6 children, 7 of 11 fetuses, 3 of 9 women with normal liver, 7 of 10 women with chronic hepatitis C, 5 of 6 women with acute liver disease during pregnancy with male offspring, and 2 of 4 non-pregnant women with fulminant hepatitis. The presence of male microchimerism was higher in diseased livers than unaffected ones. The authors suggested:

> "The presence of male cells in the liver of female children and fetuses is probably due to the transplacental transmission of fetal cells preexisting in the mother and acquired either from previous pregnancy with male offspring or during the mother's own fetal life."[82]

Figure 3. Cells exchanged between mother and baby during pregnancy can persist for decades after birth.

Fetal microchimerism as a biomarker for disease?

Can the absence or presence of fetal microchimerism be used as a biomarker for disease, such as breast cancer? A series of valid reports supports this possibility. A 2013 study is the sixth of its kind that demonstrates the possibility that microchimerism can yield a reliable marker for breast cancer risk assessment. The researchers corroborated the existing understanding that women with little detectable microchimerism are at a higher risk of in situ breast cancer.[81]

While protective in breast cancer, male microchimerism was associated with a higher risk of bowel cancer.[82] Thus, the effects of microchimerism on the breast are quite opposite to those on the bowel. The study authors stated that microchimerism was highly relevant to later cancer development.

In a review article regarding microchimerism and its potential beneficial effects, the authors state:

> "Much of the information that is currently available derives from studies of association, and causation is unknown. It is difficult to know in studies of human biopsy or autopsy samples whether microchimerism is an active participant in damage, an incidental marker of concurrent processes, or a potential contributor to repair. Some studies have found evidence of fetal cell differentiation in maternal tissue suggesting they may be involved in tissue repair in a variety of different organs."[83]

Children by multiple partners resulted in higher maternal mortality

Naturally, if fetal microchimerism can impact maternal health, then how does fetal microchimerism from different partners impact maternal health? Olsen *et al.* investigated health outcomes between women who had pregnancies by one partner and women who had pregnancies by more than one partner.[84] In this 2003 paper the authors acknowledge that a study such as theirs was prone to methodological difficulties due to problems with adjusting data for social differences in their study groups. They stated:

> "Women who had children with more than one partner had a higher relative mortality rate, which was even higher if she had children by more than two partners. This finding persisted after excluding unnatural deaths and did not depend on time from exposure. Although some of the findings were adjusted for parity, age and social factors, it is highly unlikely that these large differences are entirely related to microchimerism. The study shows that caution is needed when studying health effects of procreation with multiple partners."

The authors also said that they could not believe that such a large difference existed between the mortality rates in the women they studied based on whether the women had children by single or multiple partners. They state:

> "It is hard to believe that these major differences in mortality are all related to induced immunological changes including microchimerism of a multiple partner origin. More likely the differences reflect the impact of social factors, lifestyle, and stress related to changing partners and all the rest that goes with unstable social and personal conditions. *Reproducing with several partners seems to be a risky matter*, but most of the risk probably belongs to the domain of risky behaviour in general rather than microchimerism. Microchimerism could have causal importance for several diseases, which could lead to death after several years of follow-up time, but the microchimerism theory is not expected to manifest itself within the first years of follow-up, as we saw [emphasis added]."

Another Danish study in 2004 set out to determine if there was a cancer risk associated with women having children with multiple partners. They detected a more than 50% higher cancer rate for women that had children by more than one partner.[85] They stated that they found a higher risk of cervical and uterine cancers, as expected; and unexpectedly, they found that breast and ovarian cancers were not significantly lower in the group of women that had children with more than one partner. The results of previous studies detailing protective effects of multiple partners on risk of breast and ovarian cancer were not replicated in this study.[86] The findings of this study were similar to an earlier Swedish report from 2001, where no reduction in breast cancer risk was found in women bearing children with more than one partner; in fact the authors had reported a slightly elevated risk of cancer in the group of women that had children by two or more partners.[87]

A challenge for feminists

Feminists are confronted with a challenging situation where, in the face of their struggle for autonomy, and for characterisation as individuals without reference to their biological capacity for child bearing, they will now be forced to accept being inextricably linked biologically to not only their children, including their aborted babies, but also to their children's fathers.[88,89] There is presently no evidence that DNA from women can engraft into their husbands via sexual intimacy.

Donated eggs and embryos in assisted reproduction

In married couples with female infertility, the husband's sperm may be utilized for creation of an embryo derived with the ovum obtained from another woman. The ensuing pregnancy can result in fetal microchimerism and the foreign

female DNA may embed in the mother/recipient. Women becoming pregnant with donor eggs fertilized by their husbands have been found to have male microchimerism for as long as 9 years in one study, implying that the foreign fetal DNA avoids detection by the mother/recipient.[90]

By the same token, donated embryos may constitute a perplexing challenge for couples in terms of the spousal one-flesh union in marriage, as the fetus delivers its paternally derived DNA into the mother's body, thereby colonizing her body with the genetic heritage of the non-spouse father.[91]

Fetal microchimerism also forces bioethical considerations in gestational surrogacy. Loike and Fischbach quote a case where a child was born with a maternally derived leukaemic tumour in her cheek, highlighting the risk of diseased maternal cells migrating into the fetus and causing disease.[92] As cellular and DNA traffic is two-way, a surrogate mother's DNA is likely to embed in the biologically unrelated baby that she carries, and the baby's DNA is likely to embed in her.

Implications for lesbians using donor sperm

This process of fetal microchimerism also has implications for lesbians using donor sperm to facilitate procreation. Presently, such women may be unaware that donor male DNA will be indelibly embedded within them, enshrined vestiges of the biological process resulting in children, that requires a man and a woman, as ordained by God. Scarnecchia has said:

> "The man whose embryo implants in a woman literally becomes one-flesh with her as fetal chimeric cells bearing his genetic heritage differentiate and colonize her organs and tissues, for better or worse, till death do they part. … Because it has its causal origin in the sexual act, the fetal chimeric stem cells containing male DNA of its father's lineage that differentiates into the tissues and organs of the mother's body signifies an on-going sexual penetration of the woman's body by the paternal genetic heritage of the child."[91]

Conclusion

Having the DNA of a separate individual integrated into one's body for life, conveyed via the process of procreation, emphasises the depth of the intimacy achievable for a male and female union.

Following God's instructions contained in His Word regarding sexual behaviours results in better health outcomes for women. This is as expected since God is the author of life and He has said, in John 10:10, "The thief comes only to steal and kill and destroy. I came that they may have life and have it abundantly."

References

1. New American Standard Bible (NASB) Copyright © 1960, 1962, 1963, 1968, 1971, 1972, 1973, 1975, 1977, 1995, by The Lockman Foundation.
2. Gaillard, M.C., Ouvre, E., Liégeois, A., Lewin, D., The concentration of fetal cells in maternal haematopoietic organs during pregnancy. An experimental study in mice (author's transl), *J. Gynecol. Obstet. Biol. Reprod.* (Paris) **7**(6):1043–1050, 1978, French; PubMed PMID: 730985.
3. Miech, R.P., The role of fetal microchimerism in autoimmune disease, *Int. J. Clin. Exper. Med.* **3**(2):164–168, 2010.
4. Schmorl, G., Pathologisch-anatomische Untersuchungen über Puerperal-Eklampsie, Verlag FCW Vogel, Leipzig, 1893.
5. Lapaire, O., Holzgreve, W., Oosterwijk, J.C., Brinkhaus, R. and Bianchi, D.W., Georg Schmorl on trophoblasts in the maternal circulation, *Placenta* **28**(1):1–5, 2007, Epub, 18 April 2006; PubMed PMID: 16620961.
6. Gammill, H.S., Aydelotte, T.M., Guthrie, K.A., Nkwopara ,E.C. and Nelson, J.L., Cellular fetal microchimerism in preeclampsia, *Hypertension* **62**(6):1062–1067, 2013; doi:10.1161/HYPERTENSIONAHA.113.01486, Epub, 7 October 2013; PubMed PMID: 24101661.
7. Williams, J.W., Obstetrics: A Textbook for the Use of Students and Practitioners, Appleton Press, New York, 1907.
8. Walknowska, J., Conte, F.A. and Grumbach, M.M., Practical and theoretical implications of fetal-maternal lymphocyte transfer, *Lancet* **1**(7606): 1119–1122, 1969; PubMed PMID: 4181601.
9. Schröder, J. and De la Chapelle, A., Fetal lymphocytes in the maternal blood, *Blood* **39**(2):153–162, 1972; PubMed PMID: 4109537.
10. Schröder, J., Tiilikainen, A. and De la Chapelle, A., Fetal leukocytes in the maternal circulation after delivery—I. Cytological aspects, *Transplantation* **17**(4):346–354, 1974; PubMed PMID: 4823382.
11. Herzenberg, L.A., Bianchi, D.W., Schröder, J., Cann, H.M. and Iverson, G.M., Fetal cells in the blood of pregnant women: detection and enrichment by fluorescence-activated cell sorting, *Proc. Nat. Acad. Sci. USA* **76**(3): 1453–1455, 1979; PubMed PMID: 286330; PubMed Central PMCID: PMC383270.
12. Iverson, G.M., Bianchi, D.W., Cann, H.M. and Herzenberg, L.A., Detection and isolation of fetal cells from maternal blood using the flourescence-activated cell sorter (FACS, *Prenat. Diagn.* **1**(1):61–73, 1981; PubMed PMID: 7050957.
13. Amniocentesis is a procedure by which amniotic fluid is withdrawn from a pregnant uterus in a bid to determine fetal chromosomal abnormalities. This requires the insertion of a needle into the abdomen of the woman and carries a risk of miscarriage.
14. www.cancerresearchuk.org/cancer-help/about-cancer/cancer-questions/cervical-cancer-in-virgins.
15. McCaffery, K., Forrest, S., Waller, J., Desai, M., Szarewski, A. and Wardle, J., Attitudes towards HPV testing: a qualitative study of beliefs among Indian, Pakistani, African-Caribbean and white British women in the UK, *Br. J. Cancer* **88**(1):42–46, 2003; PubMed PMID: 12556957; PubMed Central PMCID: PMC2376794.
16. Hounsgaard, L., Augustussen, M., Møller, H., Bradley, S.K. and Møller, S., Women's perspectives on illness when being screened for cervical cancer, *Int. J. Circumpolar Health* **72**:21089, 5 Aug 2013;. doi: 10.3402/ijch.v72i0.21089, eCollection 2013; PubMed PMID: 23984277; PubMed Central PMCID: PMC3753123.
17. STD Services Royal Adelaide Hospital, Diagnosis and Management of STDs—including HIV infection, 6th edn, 2005.
18. Murthy, N.S. and Mathew, A., Risk factors for pre-cancerous lesions of the cervix, *Eur. J. Cancer Prev.* **9**(1):5–14, 2000; Review; PubMed PMID: 10777005.
19. Tubbergen, P., Lachmeijer, A.M., Althuisius, S.M., Vlak, M.E., van Geijn, H.P. and Dekker, G.A., Change in paternity: a risk factor for preeclampsia in multiparous women? *J. Reprod. Immunol.* **45**(1):81–88, 1999; PubMed PMID: 10660264.
20. Robillard, P.Y., Dekker, G.A. and Hulsey, T.C., Primipaternities in families: is the incidence of pregnancy-induced hypertensive disorders in multigravidas an anthropological marker of reproduction? *Aust. NZ J. Obstet. Gynaecol.* **38**(3): 284–287, 1998; PubMed PMID: 9761154.
21. Robillard, P.Y., Dekker, G. and Chaouat, G., Fourteen years of debate and workshops on the immunology of preeclampsia. Where are we now after the 2012 workshop? *J. Reprod. Immunol.***101–102**:62–69, 2014; doi: 10.1016/j.jri.2013.06.003, Epub, 2 August 2013; PubMed PMID: 23972718.

22. Dekker, G.A., Robillard, P.Y. and Hulsey, T.C., Immune maladaptation in the etiology of preeclampsia: a review of corroborative epidemiologic studies, *Obstet. Gynecol. Surv.* **53**(6):377–382, 1998, Review; PubMed PMID: 9618714.
23. Zhang, J. and Patel, G., Partner change and perinatal outcomes: a systematic review, *Paediatr. Perinat. Epidemiol.* **21**(1):46–57, 2007, Review; PubMed PMID: 17593197.
24. Einarsson, J.I., Sangi-Haghpeykar, H. and Gardner, M.O., Sperm exposure and development of preeclampsia, *Am. J. Obstet. Gynecol.* **188**(5):1241–1243, 2003; PubMed PMID:12748491.
25. Larsen, M.H., Bzorek, M., Pass, M.B., Larsen, L.G., Nielsen, M.W., Svendsen, S.G., Lindhard, A. and Hviid, T.V., Human leukocyte antigen-G in the male reproductive system and in seminal plasma, *Mol. Hum. Reprod.* **17**(12): 727–738, 2011; doi:10.1093/molehr/gar052, Epub, 3 August 2011; PubMed PMID: 21813635.
26. Koelman, C.A., Coumans, A.B., Nijman, H.W., Doxiadis, I.I., Dekker, G.A. and Claas, F.H., Correlation between oral sex and a low incidence of preeclampsia: a role for soluble HLA in seminal fluid? *J. Reprod. Immunol.* **46**(2): 155–166, 2000; PubMed PMID: 10706945.
27. Saftlas, A.F., Levine, R.J., Klebanoff, M.A., Martz, K.L., Ewell, M.G., Morris, C.D. and Sibai, B.M., Abortion, changed paternity, and risk of preeclampsia in nulliparous women, *Am. J. Epidemiol.* **157**(12):1108–1114, 2003; PubMed PMID: 12796047.
28. Saito, S., Sakai, M., Sasaki, Y., Nakashima, A. and Shiozaki, A., Inadequate tolerance induction may induce pre-eclampsia, *J. Reprod. Immunol.* **76**(1–2): 30–39, 2007; Epub, 1 November 2007, Review, PubMed PMID: 17935792.
29. Kho, E.M., McCowan, L.M., North, R.A., Roberts, C.T., Chan, E., Black, M.A., Taylor, R.S. and Dekker, G.A.; SCOPE Consortium., Duration of sexual relationship and its effect on preeclampsia and small for gestational age perinatal outcome, *J. Reprod. Immunol.* **82**(1):66–73, October 2009; doi: 10.1016/j.jri.2009.04.011. Epub, 12 August 2009 ; PubMed PMID: 19679359.
30. Lee, S.K., Kim, J.Y., Lee, M., Gilman-Sachs, A. and Kwak-Kim, J., Th17 and regulatory T cells in women with recurrent pregnancy loss, *Am. J. Reprod. Immunol.* **67**(4):311–318, April 2012.; doi: 10.1111/j.1600-0897.2012.01116.x; Epub, 1 March 2012, Review; PubMed PMID: 22380579.
31. Hernández-Valencia, M., Saldaña, Q.L., Alvarez, M.M. and Valdez, M.E., Barrier family planning methods as risk factor which predisposes to preeclampsia, *Ginecol. Obstet. Mex.* **68**:333–338, 2000. Spanish but with English abstract; PubMed PMID: 11055107.
32. Klonoff-Cohen, H.S., Savitz, D.A., Cefalo, R.C. and McCann, M.F., An epidemiologic study of contraception and preeclampsia, *JAMA* **262**(22): 3143–3147, 1989; PubMed PMID: 2810672.
33. Thadhani, R., Stampfer, M.J., Chasan-Taber, L., Willett, W.C. and Curhan, G.C., A prospective study of pregravid oral contraceptive use and risk of hypertensive disorders of pregnancy, *Contraception* **60**(3):145–150, 1999; PubMed PMID: 10640157.
34. Bandoli, G., Lindsay, S., Johnson, D.L., Kao, K., Luo, Y. and Chambers, C.D., Change in paternity and select perinatal outcomes: causal or confounded? *J. Obstet. Gynaecol.* **32**(7):657–662, 2012; doi: 10.3109/01443615.2012.698669; PubMed PMID: 22943712.
35. Wikström, A.K., Gunnarsdóttir, J. and Cnattingius, S., The paternal role in pre-eclampsia and giving birth to a small for gestational age infant; a population-based cohort study, *BMJ Open*. **2**(4):pii: e001178, 2012, doi:10.1136/bmjopen-2012-001178; PubMed PMID: 22936817; PubMed Central PMCID: PMC3432846.
36. The reference to 'control' relates to statistical adjustment of data that may otherwise erroneously skew the results of any given study.
37. Shah, P.S. and Zao, J.; Knowledge Synthesis Group of Determinants of preterm/LBW births, Induced termination of pregnancy and low birthweight and preterm birth: a systematic review and meta-analyses, *BJOG* **116**(11): 1425–1442, October 2009; doi:10.1111/j.1471-0528.2009.02278.x, Review; PubMed PMID: 19769749.
38. Jaddoe, V.W., de Jonge, L.L., Hofman, A., Franco, O.H., Steegers, E.A. and Gaillard, R.; First trimester fetal growth restriction and cardiovascular risk factors in school age children: population based cohort study, *BMJ* **348**:g14, 23 January 2014; doi:10.1136/bmj.g14. PubMed PMID: 24458585; PubMed Central PMCID: PMC3901421.
39. Saftlas, A.F., Rubenstein, L., Prater, K., Harland, K.K., Field, E. and Triche, E.W., Cumulative exposure to paternal seminal fluid prior to conception and subsequent risk of preeclampsia, *J. Reprod. Immunol.***101–102**:104–110, March 2014; doi: 10.1016/j.jri.2013.07.006, Epub, 15 August 2013; PubMed PMID: 24011785.
40. Robertson, S.A., Prins, J.R., Sharkey, D.J. and Moldenhauer, L.M., Seminal fluid and the generation of regulatory T cells for embryo implantation, *Am. J. Reprod. Immunol.* **69**(4):315–330, 2013; doi: 10.1111/aji.12107, Review; PubMed PMID: 23480148.
41. Kusanovic, J.P., Romero, R., Jodicke, C., Mazaki-Tovi, S., Vaisbuch, E., Erez, O., Mittal, P., Gotsch, F., Chaiworapongsa, T., Edwin, S.S., Pacora, P. and Hassan, S.S., Amniotic fluid soluble human leukocyte antigen-G in term and preterm parturition, and intra-amniotic infection/inflammation, *J. Matern Fetal Neonatal Med.* **22**(12):1151–1166, 2009; doi: 10.3109/14767050903019684; PubMed PMID: 19916713; PubMed Central PMCID: PMC3424396.
42. Steinborn, A., Varkonyi, T., Scharf, A., Bahlmann, F., Klee, A. and Sohn, C., Early detection of decreased soluble HLA-G levels in the maternal circulation predicts the occurrence of preeclampsia and intrauterine growth retardation during further course of pregnancy, *Am. J. Reprod. Immunol.* **57**(4):277–286, 2007; PubMed PMID: 17362389.
43. Swinkels, D.W., de Kok, J.B., Hendriks, J.C., Wiegerinck, E., Zusterzeel, P.L. and Steegers, E.A., Hemolysis, elevated liver enzymes, and low platelet count (HELLP) syndrome as a complication of preeclampsia in pregnant women increases the amount of cell-free fetal and maternal DNA in maternal plasma and serum, *Clin. Chem.* **48**(4):650–653, 2002; PubMed PMID: 11901066.
44. Rizzo, R., Andersen, A.S., Lassen, M.R., Sørensen, H.C., Bergholt, T., Larsen, M.H., Melchiorri, L., Stignani. M., Baricordi, O.R. and Hviid, T.V., Soluble human leukocyte antigen-G isoforms in maternal plasma in early and late pregnancy, *Am. J. Reprod. Immunol.* **62**(5):320–338, 2009; doi: 10.1111/j.1600-0897.2009.00742.x; PubMed PMID: 19811467.
45. Cecati, M., Giannubilo, S.R., Emanuelli, M., Tranquilli, A.L. and Saccucci, F., HLA–G and pregnancy adverse outcomes, *Med. Hypotheses*. **76**(6):782–784, 2011; doi: 10.1016/j.mehy.2011.02.017, Epub, 3 March 2011; PubMed PMID: 21376476.
46. Allen, V.M., Wilson, R.D. and Cheung, A., Genetics Committee of the Society of Obstetricians and Gynaecologists of Canada (SOGC); Reproductive Endocrinology Infertility Committee of the Society of Obstetricians and Gynaecologists of Canada (SOGC). Pregnancy outcomes after assisted reproductive technology, *J. Obstet. Gynaecol. Can.* **28**(3):220–250, 2006, English, French; PubMed PMID: 16650361.
47. Society of Obstetricians and Gynaecologists of Canada, Okun, N., Sierra, S., Pregnancy outcomes after assisted human reproduction, *J. Obstet. Gynaecol. Can.* **36**(1):64–83, 2014; PubMed PMID: 24444289.
48. Chen, X.K., Wen, S.W., Bottomley, J., Smith, G.N., Leader, A. and Walker, M.C., In vitro fertilization is associated with an increased risk for preeclampsia, *Hypertens. Pregnancy* **28**(1):1–12, 2009; doi: 10.1080/10641950802001859; PubMed PMID: 19165665.
49. Bischoff, F.Z., Lewis, D.E., Nguyen, D.D., Murrell, S., Schober, W., Scott, J., Simpson, J.L. and Elias, S., Prenatal diagnosis with use of fetal cells isolated from maternal blood: five-color fluorescent in situ hybridization analysis on flow-sorted cells for chromosomes X, Y, 13, 18, and 21, *Am. J. Obstet. Gynecol.* **179**(1):203–209, 1998; PubMed PMID: 9704788.
50. Bianchi, D.W., Simpson, J.L., Jackson, L.G., Elias, S., Holzgreve, W., Evans, M.I., Dukes, K.A., Sullivan, L.M., Klinger, K.W., Bischoff, F.Z., Hahn, S., Johnson, K.L., Lewis, D., Wapner, R.J. and de la Cruz, F., Fetal gender and aneuploidy detection using fetal cells in maternal blood: analysis of NIFTY I data. National Institute of Child Health and Development Fetal Cell Isolation Study, *Prenat. Diagn.* **22**(7):609–615, 2002; PubMed PMID: 12124698.
51. Bianchi, D.W., Parker, R.L., Wentworth, J., Madankumar, R., Saffer, C., Das, A.F., Craig, J.A., Chudova, D.I., Devers, P.L., Jones, K.W., Oliver, K., Rava, R.P. and Sehnert, A.J., CARE Study Group, DNA sequencing versus standard prenatal aneuploidy screening, *New Engl. J. Med.* **370**(9):799–808, 2014; doi: 10.1056/NEJMoa1311037; PubMed PMID: 24571752.
52. Wright, C.F., Wei, Y., Higgins, J.P. and Sagoo, G.S., Non-invasive prenatal diagnostic test accuracy for fetal sex using cell-free DNA a review and meta-analysis, *BMC Res. Notes* **5**:476, 1 September 2012;; doi: 10.1186/1756-0500-5-476, Review; PubMed PMID: 22937795; PubMed Central PMCID: PMC3444439.
53. Costa, J.M., Benachi, A., Gautier, E., Jouannic, J.M., Ernault, P. and Dumez, Y., First-trimester fetal sex determination in maternal serum using real-time PCR, *Prenat. Diagn.* **21**(12):1070–1074, December 2001. Erratum in: *Prenat. Diagn.* **22**(13):1242, 2002; PubMed PMID: 11746166.
54. Gammill, H.S. and Nelson, J.L., Naturally acquired microchimerism, *Int. J. Dev. Biol.* **54**(2–3):531–543, 2010; doi: 10.1387/ijdb.082767hg, Review; PubMed PMID: 19924635; PubMed Central PMCID: PMC2887685.
55. Gammill, H.S., Adams Waldorf, K.M., Aydelotte, T.M., Lucas, J., Leisenring, W.M., Lambert, N.C. and Nelson, J.L., Pregnancy, microchimerism, and the maternal grandmother, *PLoS On.* **6**(8):e24101, 2011; doi: 10.1371/journal.pone.0024101, Epub 30 August 2011; PubMed PMID: 21912617; PubMed Central PMCID: PMC3166068.
56. Maloney, S., Smith, A., Furst, D.E., Myerson, D., Rupert, K., Evans, P.C. and Nelson, J.L., Microchimerism of maternal origin persists into adult life, *J. Clin. Invest.* **104**(1):41–47, 1999; PubMed PMID: 10393697; PubMed Central PMCID: PMC408407.
57. Mold, J.E., Michaëlsson, J., Burt, T.D., Muench, M.O., Beckerman, K.P., Busch, M.P., Lee, T.H., Nixon, D.F. and McCune, J.M., Maternal alloantigens promote the development of tolerogenic fetal regulatory T cells in utero, *Science* **322**(5907):1562–1565, 2008; doi:10.1126/science.1164511; PubMed PMID: 19056990; PubMed Central PMCID: PMC2648820.

58. Erlebacher, A., Mechanisms of T cell tolerance towards the allogeneic fetus, *Nat. Rev. Immunol.* **13**(1):23–33, 2013; doi: 10.1038/nri3361, Epub 14 December 2012, Review; PubMed PMID: 23237963.

59. Burlingham, W.J., A lesson in tolerance—maternal instruction to fetal cells, *New Engl. J. Med.* **360**(13):1355–1357, 2009; doi: 10.1056/NEJMcibr0810752; PubMed PMID: 19321873; PubMed Central PMCID: PMC2886144.

60. Rodeck, C.H. and Whittle, M.J., *Fetal Medicine Basic Science and Clinical Practice*, Elsevier Health Sciences, p. 114, 2009.

61. Kara, R.J., Bolli, P., Karakikes, I., Matsunaga, I., Tripodi, J., Tanweer, O., Altman, P., Shachter, N.S., Nakano, A., Najfeld, V. and Chaudhry, W., Fetal cells traffic to injured maternal myocardium and undergo cardiac differentiation, *Circ. Res.* **110**:82– 93, 2012.

62. O'Donoghue, K., Chan, J., de la Fuente, J., Kennea, N., Sandison, A., Anderson, J.R.,

Roberts, I.A. and Fisk, N.M., Microchimerism in female bone marrow and bone decades after fetal mesenchymal stem-cell trafficking in pregnancy, *Lancet* **64**(9429):179–182, 2004.;PubMed PMID: 15246731.

63. Lau, T.K., Lo, K.W., Chan, L.Y., Leung, T.Y. and Lo, Y.M., Cell-free fetal deoxyribonucleic acid in maternal circulation as a marker of fetal-maternal hemorrhage in patients undergoing external cephalic version near term, *Am. J. Obstet. Gynecol.* **183**(3):712–716, 2000; PubMed PMID: 10992198.

64. Bianchi, D.W., Farina, A., Weber, W., Delli-Bovi, L.C., Deriso, M., Williams, J.M. and Klinger, K.W., Significant fetal-maternal hemorrhage after termination of pregnancy: implications for development of fetal cell microchimerism, *Am. J. Obstet. Gynecol.* **184**(4):703–706, 2001; PubMed PMID: 11262475.

65. Peterson, S.E., Nelson, J.L., Guthrie, K.A., Gadi, V.K., Aydelotte, T.M., Oyer, D.J., Prager, S.W. and Gammill, H.S., Prospective assessment of fetal-maternal cell transfer in miscarriage and pregnancy termination, *Hum. Reprod.* **27**(9):2607–2612, 2012; doi: 10.1093/humrep/des244, Epub 29 June 2012; PubMed PMID: 22752611; PubMed Central PMCID: PMC3415291.

66. Sunam, R., Komuro, M, Tagaya, H. and Hirata, S., Migration of microchimeric fetal cells into maternal circulation before placenta formation, *Chimerism* **1**(2):66–68, 2010; PubMed PMID: 21327051; PubMed Central PMCID: PMC3023627.

67. Wegorzewska, M., Nijagal, A., Wong, C.M., Le, T., Lescano, N., Tang, Q. and MacKenzie, T,C., Fetal intervention increases maternal T cell awareness of the foreign conceptus and can lead to immune-mediated fetal demise, *J. Immunol.* **192**(4):1938–1945, 2014. doi: 10.4049/jimmunol.1302403, Epub 10 January 2014; PubMed PMID: 24415782.

68. Yan, Z., Lambert, N.C., Guthrie, K.A., Porter, A.J., Loubiere, L.S., Madeleine, M.M., Stevens, A.M., Hermes, H.M. and Nelson, J.L., Male microchimerism in women without sons: quantitative assessment and correlation with pregnancy history, *Am. J. Med.* **118**(8):899–906, 2005; PubMed PMID: 16084184.

69. Lambert, N.C., Pang, J.M., Yan, Z., Erickson, T.D., Stevens, A.M., Furst, D.E. and Nelson, J.L., Male microchimerism in women with systemic sclerosis and healthy women who have never given birth to a son, *Ann. Rheum. Dis.* **64**(6):845–848, 2005, Epub 18 November 2004; PubMed PMID: 15550532; PubMed Central PMCID: PMC1755528.

70. Fugazzola, L., Cirello, V. and Beck-Peccoz, P., Fetal microchimerism as an explanation of disease, *Nat. Rev. Endocrinol.* **7**(2):89–97, 2011; doi: 10.1038/nrendo.2010.216, Epub 21 December 2010, Review; PubMed PMID: 21178998.

71. Bianchi, D.W., Zickwolf, G.K., Weil, G.J., Sylvester, S. and DeMaria, M.A., Male fetal progenitor cells persist in maternal blood for as long as 27 years postpartum, *Proc. Natl. Acad. Sci. USA* **93**(2):705–708, 1996.

72. Ando, T. and Davies, T.F., Clinical Review 160: Postpartum autoimmune thyroid disease: the potential role of fetal microchimerism, *J. Clin. Endocrinol. Metab.* **88**(7):2965–2971, 2003.

73. Klintschar, M., Immel, U.D., Kehlen, A., Schwaiger, P., Mustafa, T., Mannweiler, S., Regauer, S., Kleiber, M. and Hoang-Vu, C., Fetal microchimerism in Hashimoto's thyroiditis: a quantitative approach, *Eur. J. Endocrinol.* **154**(2):237–241, 2006.

74. Jameson, J.L., Evidence for Fetal Microchimerism in Autoimmune Thyroid Disease, Harrison's Online: *Harrison's Principles of Internal Medicine*, 17e, chap. 320, 9 April 2002.

75. Lapaire, O., Hösli, I., Zanetti-Daellenbach, R., Huang, D., Jaeggi, C., Gatfield-Mergenthaler, S., Hahn, S. and Holzgreve, W., Impact of fetal-maternal microchimerism on women's health—a review, *J. Matern. Fetal. Neonatal. Med.* **20**(1):1–5, 2007, Review; PubMed PMID: 17437192.

76. Koopmans, M., Kremer Hovinga, I.C., Baelde, H.J., Fernandes, R.J., de Heer, E., Bruijn, J.A. and Bajema, I.M., Chimerism in kidneys, livers and hearts of normal women: implications for transplantation studies, *Am. J. Transplant.* **5**(6):1495–1502, 2005; PubMed PMID: 15888060.

77. Koopmans, M., Kremer Hovinga, I.C., Baelde, H.J., Harvey, M.S., de Heer, E., Bruijn, J.A. and Bajema, I.M., Chimerism occurs in thyroid, lung, skin and lymph nodes of women with sons, *J. Reprod. Immunol.* **78**(1):68–75, June 2008; doi: 10.1016/j.jri.2008.01.002. Epub 7 March 2008; PubMed PMID: 18329105.

78. Bayes-Genis, A., Bellosillo, B., de la Calle, O., Salido, M., Roura, S., Ristol, F.S., Soler, C., Martinez, M., Espinet, B., Serrano, S., Bayes de Luna, A. and Cinca, J., Identification of male cardiomyocytes of extracardiac origin in the hearts of women with male progeny: male fetal cell microchimerism of the heart, *J. Heart Lung Transplant.* **24**(12):2179–2183, 2005, Epub 28 September 2005; PubMed PMID: 16364868.

79. Chan, W.F., Gurnot, C., Montine, T.J., Sonnen, J.A., Guthrie, K.A. and Nelson, J.L., Male microchimerism in the human female brain, *PLoS One* **7**(9):e45592, 2012; doi: 10.1371/journal.pone.0045592, Epub 26 September 2012; PubMed PMID: 23049819; PubMed Central PMCID: PMC3458919.

80. Guettier, C., Sebagh, M., Buard, J., Feneux, D., Ortin-Serrano, M., Gigou, M., Tricottet, V., Reynès, M., Samuel, D., Féray, C., Male cell microchimerism in normal and diseased female livers from fetal life to adulthood, *Hepatology* **42**(1):35–43, 2005; PubMed PMID: 15962317.

81. Eun, J.K., Guthrie, K.A., Zirpoli, G. and Gadi, V.K., In situ breast cancer and microchimerism, *Sci. Rep.* **3**:2192, 2013; doi: 10.1038/srep02192; PubMed PMID: 23846681; PubMed Central PMCID: PMC3709160.

82. Kamper-Jørgensen, M., Biggar, R.J., Tjønneland, A., Hjalgrim, H., Kroman, N., Rostgaard, K., Stamper, C.L., Olsen, A., Andersen, A.M. and Gadi, V.K., Opposite effects of microchimerism on breast and colon cancer, *Eur. J. Cancer* **48**(14):2227–2235, 2012; doi: 10.1016/j.ejca.2012.02.006, Epub 2012 Mar 5; PubMed PMID: 22397765.

83. Gammill, H.S. and Nelson, J.L., Naturally acquired microchimerism, *Int. J. Dev. Biol.* **54**(2–3):531–543, 2010; doi: 10.1387/ijdb.082767hg, Review; PubMed PMID: 19924635; PubMed Central PMCID: PMC2887685.

84. Olsen, J., Campi, R., Frydenberg, M., Basso, O. and Ebbesen, P., Studying health consequences of microchimerism: methodological problems in studying health effects of procreation with multiple partners, *Eur. J. Epidemiol.* **18**(7):623–629, 2003; PubMed PMID: 12952135.

85. Campi, R., Frydenberg, M., Basso, O., Ebbesen, P. and Olsen, J., Having children with different men and subsequent cancer risk. A nationwide study in Denmark, *Br. J. Cancer* **90**(7):1374–1377, 2004; PubMed PMID: 15054457; PubMed Central PMCID: PMC2409672.

86. The study authors stated that their raw data showed a relative risk reduction that was significant, but this disappeared after data adjustment relating to socioeconomic factors was included in the model.

87. Lambe, M., Rossing, M.A., Wuu, J. and Hsieh, C., Breast cancer risk in women who have had children with different partners, *Int. J. Cancer* **93**(6):907–910, 2001; PubMed PMID: 11519056.

88. www.biomedsearch.com/article/Your-mothers-always-with-you/257127027.html.

89. Invernizzi, P., Biondi, M.L., Battezzati, P.M., Perego, F., Selmi, C., Cecchini, F., Podda, M. and Simoni, G., Presence of fetal DNA in maternal plasma decades after pregnancy, *Hum. Genet.* **110**(6):587–591, 2002, Epub 18 April 2002; PubMed PMID: 12107445.

90. Williams, Z., Zepf, D., Longtine, J., Anchan, R., Broadman, B., Missmer, S.A. and Hornstein, M.D., Foreign fetal cells persist in the maternal circulation, *Fertil. Steril.* **91**(6):2593–2595, 2009; doi: 10.1016/j.fertnstert.2008.02.008, Epub 1 April 2008; PubMed PMID: 18384774.

91. Scarnecchia, D.B., Public policy recommendations concerning prenatal adoption of frozen embryos in light of fetal microchimerism, *Ave Maria Law Rev.* **11**(2):263, 2012–2013; legacy.avemarialaw.edu/lr/assets/articles/v11i2.Scarnecchia.pdf.

92. Loike, J. and Fischbach, R., New ethical horizons in gestational surrogacy, *J. IVF Reprod. Med. Genet.* **1**:2, 2013.

Dr Kathy Wallace, BA, BHSc Hons, BM BS, FRACGP.

Kathy is a medical doctor who works as a GP in Adelaide, South Australia. She did her undergraduate studies at University of Adelaide, with Honours in Neuropathology, and graduate-entry medicine at Flinders University. Her husband, Russell, is a trained pastor and street evangelist and both have a long-standing history of volunteer involvement with CMI ministry.

Instructions to Authors

JOURNAL OF CREATION is dedicated to upholding the authority of the 66 books of the Bible, especially in the area of origins. All our editors adhere to the Creation Ministries International (CMI) Statement of Faith and most papers will be designed to support this. Rarely, other papers may be accepted for publication on merit so that certain issues can be clarified. The views expressed in the papers are those of the authors and not necessarily those of CMI.

Because the scope of this journal is broad, we welcome articles on any topic that is relevant to biblical creation. This includes the sciences such as geology, chemistry, biology, astronomy, etc., and also archaeology, theology, hermeneutics, biblical history, geography, linguistics, ethics and society, philosophy, law, etc. Potential authors should familiarise themselves with the journal and its position and style before submitting articles. Authors should also indicate if their manuscript has been submitted elsewhere, address previous articles on the topic, and ensure the work of others is properly acknowledged.

Word length: Shorter articles are more likely to be read so preference will be given to publishing them. All articles, including letters, may be edited for brevity and clarity. Perspectives: 1,000–2,000 words; Book reviews: 1,500–3,000 words, but please enquire first. You may be asked to scan the cover of the book; Letters to the editor: 1,000 words. We will publish critical letters on articles already published, but a reply will usually follow the criticism; Papers, Overviews, Countering the Critics, Viewpoints and Essays: <5,000 words.

Articles must be written clearly and concisely and should be focused on only one topic/subject. The most readable articles are those with an average sentence length of about 17 words, with one idea per sentence. Do not use too many big or extra words such as "in spite of the fact that" when "although" would do. Please use first person sparingly and do not use "this present writer", which is verbose false modesty and ambiguous. Care with spelling is crucial, and British spelling generally applies. Personal invective or similar comments against others are not acceptable.

Specialist technical terms and abbreviations should be defined the first time they are used. If many technical terms are used, these should be included in a glossary. SI units should be used in scientific papers. Words in non-Latin alphabets (e.g. Hebrew, Greek and Russian) must use Unicode characters and be accompanied by a transliteration, also in Unicode characters (Unicode should avoid errors when the file is transferred to a publishing program or HTML).

Abstract: All articles except Perspectives, Letters and Book Reviews should be preceded by an Abstract, which should not exceed 200 words and must be without abbreviations and reference citations. The Abstract should summarise the key points of the paper and be comprehensible to readers before they have read the paper.

References should be indicated in the main text by superscript numbers in sequence and then listed in numerical order at the end of the text (End Notes). Full details of all references are required, including all authors and their initials, the full title of the paper or book, the full title of the journal or its accepted abbreviation, the volume number, the page number(s), the editor(s) of the book or proceedings (if applicable), the publishers and place of publication (in the case of a book), and the year of publication. If a citation is repeated, then the same superscript number should be used (a cross reference).

Quotes must be verbatim, with omissions clearly shown by ellipsis (...). Even erroneous grammar and spelling in the original must be reproduced, and indicated by [sic]. Any additions or explanations within a quote need to be placed in square brackets [ ]. Primary sources are preferred, but if a secondary source must be used, the reference format must be [primary source], as cited in [secondary source]. For internet URLs the date last downloaded should be included.

Tables should be embedded in a Microsoft Word document, with brief, self-explanatory titles, and captions if an explanation is essential to understanding the table. Tables should be numbered according to their sequence in the text and all should be referred to in the text, e.g. (see table 1).

Graphics should be supplied electronically on CD or by email to journal@creation.info as 300dpi *.TIF, *.EPS, *.PSD, *.AI, *.JPG, *.PDF or *.BMP files, not embedded into a document file. They can be sent in colour or greyscale, but will appear only in greyscale in the journal. Graphics should have a minimum size of 80 mm x 80 mm when printed (preferably 1024 x 768 pixels). Photographs are acceptable provided they have good contrast and intensity, and are submitted as sharp, glossy copies or as 35 mm slides. Computer print-outs are not acceptable.

Figures should be numbered according to their sequence in the text. References should be made in the text to each figure. In planning images and figures, the page format and column widths of the journal should be kept in mind and should allow for the possibility of reduction. Each illustration should have a self-explanatory caption. The captions should be collected together at the end of the article document file. If graphics are not provided with a manuscript, authors may be asked to submit suggestions and possible sources of non-restricted material.

Copyright ownership for each and every graphic must be specified and any relevant permissions and or credit requirements given in writing. If you are not the copyright owner, please supply written permission (preferably with an original signature) from the copyright owner. If you are the copyright owner, your submission of a graphic will be taken to grant us permission to use the image in the journal and also any other publications or on our website, unless you specify otherwise.

Biography: Papers, Overviews, Countering the Critics, Forums, Viewpoints, Research Notes and Essays should include a biography of no more than 100 words for each author. It should include the authors' qualifications and experience, and involvement in creationist work.

Please also:

- send documents in Rich Text (*.rtf) or Word (*.doc) format, not Publisher (*.pub) format. Excel (*.xls) is also acceptable for complicated tables.
- type left-justified without hyphenation except for compound words
- input text continuously; only insert hard returns at the end of sections, lists, etc.
- use single spaces after each sentence within a paragraph
- use Times New Roman 10.5 font and use the word processing formatting features to indicate bold, italics, Greek, Hebrew, maths, superscript and subscript characters
- submit complex mathematical formulas or equations using MathType according to the guidelines in our "Equations layout guide", which can be obtained by contacting us
- insert captions for graphics at the end of your manuscript
- type references in the correct order and style of the journal using the word processing "Endnotes" and "Cross-references" features to link references to the text correctly.

Photographs and/or CDs may be sent to:journal@creation.info

The Editor,
Journal of Creation
Creation Ministries International
P.O. Box 4545
Eight Mile Plains QLD 4113
AUSTRALIA

NOTE: Papers prepared according to these instructions are more likely to be considered.

Creationist research NEEDS YOU

Christians need to keep on providing scientific answers within a biblical framework, and refining our case (including exposing whatever flaws there may be in old arguments). We also need to be ready to respond to challenges by critics.

Faith-funded creationist ministries like *Creation Ministries International Ltd* (CMI) can only do so much, not having access to taxpayer dollars.

Creationist membership societies with hundreds of scientist members are encouraging by their very existence. But they are usually just as hampered by funding constraints, and would dearly love more of their members to get involved in actively helping the creationist model.

We have many qualified scientists and other educated professionals on our mailing lists, and we would like to encourage more of you to each give just a little bit of spare time to creation research issues.

GETTING INFORMED

Start by getting as informed as possible through the existing literature. CMI can provide up-to-date catalogues.

JOINING THE NETWORK

Consider researching a particular area with a view to producing a paper. *Journal of Creation* is a great place to air it. CMI is more than willing to provide refereeing through our contacts. If you are concerned that publishing in a creationist journal might affect your employment, for example, a pseudonym may be acceptable. If you are keen to write, see our instructions to authors opposite.

Remember that the creation/evolution issue is often not so much about *facts* as about their *interpretation*. Often the research results produced by secular institutions operating within an evolutionary framework can be just as useful in providing answers for creationists—it just needs someone to go to the trouble of working it through. We can provide some guidance about how you can draw your research into a suitable paper.

NO CONTRIBUTION TOO SMALL

Even producing a brief Perspective item on a specialist area, if it will teach and inform *Journal of Creation* readers, and enable them to share with others, is a worthwhile contribution.

AND FINALLY …

You might want to consider a donation earmarked specifically for creationist research. If so, you could direct it to any of the CMI offices listed at the front of this journal. Such donations may be tax deductible in certain countries.

CREATION MINISTRIES INTERNATIONAL
CREATION.com

THE FAMILY COMPANION TO

JOURNAL OF CREATION

CREATION magazine

IN A WORLD FLOODED WITH ANTI-CHRISTIAN MEDIA, it's nice to come home to a publication that upholds the truth of God's Word ... all the way from Genesis. Packed full of fascinating articles and beautiful full-colour photography. Creation appeals to both young and old.

Enjoy subjects ranging from the wonders of nature to creation/evolution, archaeology and practical Christian living.

Special children's section sure to interest your younger family members.

Join subscribers across the globe and let *Creation* magazine be your family's life-changing experience too!

// 56
PAGES OF FULL
COLOUR
[NO PAID ADVERTISING]

Subscribe via CREATION.com, mail or phone
(see inside front cover for contact details).

ISSN 1036-2916
9 771036 291007 01